

Sixth Edition

Oral Medicine and Medically Complex Patients

EDITED BY

Peter B. Lockhart



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Sixth Edition

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Oral Medicine and Medically Complex Patients

Sixth Edition

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P.B.L.

Introduction

There is ongoing concern about the availability and quality of dental care for people with complex medical and physical conditions, and those with nonsurgical problems of the maxillofacial region. Some of these patient populations have better access than others to quality clinical services, sources of funding, and/or advocacy groups. In addition to these barriers to care, there is a longstanding shortage of dentists trained to manage these problems. Dental students generally have minimal exposure to medically complex patients and clinical problems that define the specialty area of oral medicine, and there is a need for more medical-center–based residency programs in hospital dentistry and oral medicine for the pre- and postdoctoral trainees who are called upon to manage this growing population.

Special needs dentistry in the United States, often referred to as hospital dentistry, is practiced by a relatively small but dedicated group of clinicians. Some have postdoctoral training in medical-center–based residencies and many acquired these skills during their careers. Special needs patients have a broad range of medical, physical, and emotional conditions, and many of them require dental care in nontraditional settings of the emergency room and operating room, and at the bedside. Clinical space, specialized equipment, and trained support staff are also necessary elements for access to care for special needs patients. Larger hospitals may have fully staffed and equipped dental departments that provide care to hospitalized patients, as well as to ambulatory medically complex patients from the surrounding community. The majority of hospitals in the United States, however, offer neither inpatient or outpatient dental services, and these people must seek care from a wide variety of community-based medical and dental practitioners.

Formal, postdoctoral, hospital-based training programs for recent dental school graduates began in the United States in the 1930s with one-year, elective “rotating dental internships.” Over the following decades, these residencies gained popularity among dental students who recognized their lack of training, and they helped to create the demand for expansion in the number of these programs. General practice residencies (GPRs) became more uniformly structured and two-year programs evolved by the mid-1970s. Formal accreditation guidelines set minimal requirements

for the clinical and didactic components, and they are accredited by the Commission on Dental Accreditation.

The GPR should integrate dental residents into the medical center such that they have parity with their medical and surgical colleagues in training. They should focus on aspects of clinical and didactic training beyond that available in dental schools, to include exposure to difficult cases of infection, trauma, bleeding, and pain, as well as to a wide spectrum of nonsurgical problems of the maxillofacial region. Such complex dental care services require at least a basic understanding of physical risk assessment, general medicine, principles of anesthesia, and exposure to a variety of other disciplines and skills. Medically complex patients also require the integration and coordination of dental and medical care plans through interdisciplinary teamwork.

In the United States, there are two professional groups that have been in existence for more than 70 years to support dentists with a commitment to these patient populations. One is the Chicago-based Special Care Dentistry Organization (originally the American Association of Hospital Dentists), which, in addition to hospital dentistry, also represents the fields of geriatrics and people with disabilities. The other group is the American Academy of Oral Medicine (AAOM), which focuses on two major patient populations: medically complex patients and those with nonsurgical problems of the maxillofacial region.

These two clinical disciplines, medically complex patients and clinical oral medicine, are organized and practiced somewhat differently throughout the world. In some countries, medically complex patients and oral medicine are separate disciplines, and in others they are combined under one dental specialty, as is the case with the AAOM. Two publications from the Fifth World Workshop in Oral Medicine (WWOM V) addressed the current status of oral medicine clinical practice internationally.^{1,2} A survey was sent to oral medicine practitioners in 40 countries on six continents, and it revealed that there are significant differences in the definition of oral medicine practice throughout the world. Depending on the country, practitioners focus on a wide variety of clinical problems to include oral mucosal diseases, salivary gland dysfunction, oral manifestations of systemic diseases, and maxillofacial pain conditions.

The other WWOM V publication involved an international survey concerning postgraduate oral medicine training internationally.² Individual e-mails were sent to all known oral medicine faculty in oral medicine, who were asked to complete an online survey. Responses from 37 countries indicated that 22 of 37 had oral medicine as a distinct field of study. Although there was considerable diversity in oral medicine training programs, there were strong similarities in focus of these international programs.

¹ Stoopler ET, Shirlaw P, Arvind M, Lo Russo L, Bez C, De Rossi S, Garfunkel AA, Gibson J, Liu H, Liu Q, Thongprasom K, Wang Q, Greenberg MS, Brennan MT. An international survey of oral medicine practice: proceedings from the 5th world workshop in oral medicine. *Oral Dis.* 17 (Suppl. 1):99–104. 2011.

² Rogers H, Sollecito TP, Felix DH, Yepes JE, Williams M, D'Ambrosio JA, Hodgson TA, Prescott-Clements L, Wray D, Kerr AR. An international survey in postgraduate training in oral medicine. *Oral Dis.* 17 (Suppl. 1):95–98. 2011.

The challenge for the future is to define and approve an internationally accepted baseline training for oral medicine at both the dental school and postgraduate level and agreement as to the patient populations that make up this specialty. The further development of specialty examinations, credentialing, and international cooperation in the form of scientific meetings and research will translate into better care for all of these patient populations.

Oral Medicine and Medically Complex Patients

Sixth Edition

In-Hospital Care of the Dental Patient

Dental Admissions

Introduction

Both the medical health and the dental needs of patients must be considered when deciding on hospital admission. Hospital admission should be considered whenever the required treatment could threaten the patient's well-being, or indeed life, or when the patient's medical problems may seriously compromise the treatment.

Reasons for Admission

The reasons for admission to the hospital can be categorized into two groups: emergent hospitalizations, usually from the emergency department, or elective/scheduled hospitalizations for specific oral surgical or dental procedures.

Fractures of the Mandible/Maxillofacial Structures Admission to the hospital is necessary for the management of multisystem injuries or injuries concomitant to mandible/maxillofacial fractures. It may be required for medically complex or special needs patients.

Infection Admission is necessary if the patient has an infection that:

- Compromises nutrition or hydration (especially fluid intake, e.g., severe herpetic stomatitis in very young children, which might require hospitalization because of dehydration)

2 Oral Medicine and Medically Complex Patients

- Compromises the airway (e.g., Ludwig's angina)
- Involves secondary soft tissue planes that drain or traverse potential areas of particular hazard and so are a danger to the patient (e.g., retropharyngeal or infratemporal abscesses)

Compromised Patients Medically, mentally, or physically compromised patients who are insufficiently cooperative to be treated in an outpatient setting may be admitted to hospital for their procedure. This category includes patients who might require general anesthesia or deep sedation and/or appropriate cardiorespiratory monitoring during treatment (e.g., anxiety disorders).

Children Young children who require treatment under deep sedation or general anesthesia because of the combination of poor cooperation and the need for a large number of dental procedures as a result of extensive caries and/or consequent infection may be admitted to the hospital.

Medical Consultations

Objectives

The objectives of medical consultations are to:

- Determine and reduce peri- and postoperative medical risk to the patient from the planned oral surgical/dental procedures
- Determine, and thus lessen or indeed prevent, the effects of the proposed surgery/procedures on any medical illness and limit possible post-procedure complications by managing and treating the patient's underlying medical conditions

The Patient's Medical History

The Admission Note

Introduction

There is an art to eliciting the correct, pertinent, and relevant information regarding a patient's current medical and physical status. Taking an accurate, relevant, and concise medical history requires repeated practice and experience. The goal is to obtain sufficient information from the patient to facilitate the physical examination and, in conjunction with the examination, to arrive at a working diagnosis or diagnoses of the problem.

Old hospital records, if they exist, can be immeasurably helpful in providing information about past hospitalizations, operations (including complications), and medications, particularly if the reliability of the patient or guardian as an informant is in question.

Key Points for Taking a Medical History

- Record the patient's positive and negative responses.
- Remember that the patient might not understand the need for, and value of, an accurate medical history in the dental setting.
- Be persistent and patient.
- Confirm the veracity of the information by reframing the questions (e.g., ask patients to list their current medical problems; a bit later ask for a list of their current medications; follow this up by asking the patient to detail what each specific drug/medication is used for).
- If you need to use an interpreter, try as much as possible to use a professional healthcare interpreter and not members of the patient's family.
- If you need to gain consent for minors and intellectually impaired adults or elders, make sure that the person whose consent you gain (patient's parent/guardian/caregiver) has the legal authority to provide consent.

Elements of the History

The following discussion of the components of the medical history is directed at providing a full and complete history. Often, a shorter form of the medical history is sufficient for a healthy patient admitted for routine care (e.g., extraction of teeth).

Informant and Reliability Note the name of the person or material used to obtain the pertinent information (e.g., patient, parent, relative, medical/nursing record). Also note whether the informant was reliable—were your questions understood, was the informant coherent and knowledgeable, and how well does he or she know the patient?

Chief Complaint (CC) Record what patients perceive to be the problem that brought them to the hospital. The patient's own words should be used if possible.

History of Present Illness (HPI) Make a chronologic description of the development of the chief complaint. Record the following:

- When the symptoms started
- The course since onset—the duration and progression
- Whether the symptoms are constant or episodic (if episodic, note the nature and duration of any periods of remission and exacerbation)
- The character of the symptoms (e.g., sharp, dull, burning, aching) and severity (e.g., impact on daily living)
- Any systemic signs and/or symptoms (e.g., weight gain or loss, chills, fever)
- Previous diagnoses and the results of previous trials (success, partial resolution, or unsuccessful) with treatment and/or medication related to the chief complaint

Past Dental History You now need to gather as full a past dental history as possible. Ask the patient about:

- Previous oral surgery, orthodontics (age, duration), periodontics, endodontics (tooth, date, reason), prosthetics, other appliances, oral mucosal problems (e.g., secondary herpes, aphthae), dental trauma
- Frequency of dental visits (regular or emergency only)
- Frequency of dental cleanings (when were the patient's teeth last cleaned?)
- Experience with local anesthesia/sedation (if possible, find out what type was used) and general anesthesia (e.g., allergy, syncope) (Appendix 12, Table A12-7)
- Experience with extractions—was there postoperative bleeding or infection? How well did they heal?
- History of pain, swelling, bleeding, abscess, toothaches
- Temporomandibular joint—history of pain, clicking, subluxation, trismus, crepitus
- Habits including nail-biting, thumb-sucking, clenching, bruxing, mouth-breathing
- Fluoride exposure—was this systemic or topical?
- Home care—brushing method and frequency, instruction, floss or other aids; caregiver assistance required?
- Food habits/diet—ask about form and frequency of sucrose exposure (including liquid oral medicines). For children, the history and frequency of bottle and breastfeeding as well as between-meal snacking should be included. Find out about nutritional supplements (form and consistency), liquid diets, tube feedings
- Problems with saliva (hyper-/hypo-salivation) chewing, speech
- Negative dental experiences

Past Medical History (PMH) Direct questioning is probably the best way to elicit the patient's past medical history.

Ask the patient "Are you being treated for anything by your doctor at the moment?" If the answer is "Yes," ascertain how severe the condition is (the extent to which it interferes in daily living activities) and how stable it is. A severe condition (e.g., angina) might prove not to be a significant hindrance to planned dental treatment as long as it is well managed and stable. However, a patient with unstable angina should not be treated until the angina is stabilized, or if this is not practical, treatment should be planned while the patient is monitored, and possibly lightly sedated, to minimize stress and anxiety.

Ask the patient "Have you been treated in the past, or are you currently being treated for any of the following":

- Rheumatic fever, heart murmurs, infective endocarditis, angina, heart attack, or an irregular heart beat
- Asthma, emphysema, hay fever, or allergic rhinitis or sinusitis
- Epilepsy, stroke, or nervous or psychiatric conditions?
- Diabetes or thyroid conditions
- Peptic or gastric ulcer disease or liver disease (e.g., hepatitis or cirrhosis)
- Kidney problems: Obstruction, stones, or infection

- Urinary problems: Obstruction or infection
- Gynecologic or “women’s” problems. Ask, “Are you pregnant?”
- Rheumatoid or osteoarthritis, osteoporosis, back or spinal problems
- Skin cancer or rashes
- HIV
- Infection requiring antibiotics
- Ask “Do you have a prosthetic valve or joint?”

If the patient is currently receiving treatment for cancer, find out the mode and schedule of treatment (surgery, chemotherapy, or radiotherapy). Finally, ask if the patient has ever required a blood transfusion or other blood products (platelets, plasma, or clotting factors).

Review of Systems

As part of the past medical history, you need to question the patient systematically about all of the body systems. It is often possible to obtain significant additional symptoms or information not elicited in the discussion of the patient’s past and present illness. A positive (“yes”) response should be probed in depth and significant negatives (“no”) must also be noted.

General This includes weight loss or gain, anorexia, general health throughout life, strength and energy, fever, chills, and night sweats.

Cardiovascular This includes palpitations, chest pain or pressure with or without radiation, orthopnea (number of pillows), cyanosis, edema, varicosities, phlebitis, and exercise tolerance.

Respiratory Ask about cough, sputum production (taste, color, consistency, odor, amount/24 hours) hemoptysis, dyspnea, wheezing, cyanosis, fainting, and pain with deep inspiration.

Neurologic Questions about this system should include loss of smell, taste, or vision; muscle weakness or wasting; muscle stiffness; paresthesia; anesthetics; lack of coordination; tremors; syncope; fatigue; aphasia; memory changes; and paralysis.

Psychiatric/Emotional Ask about general mood, problems with “nerves,” bruxism/clenching, habits or tics, insomnia, hallucinations, delusions, and medications. Ask children about sleeping patterns and night terrors/nightmares.

Endocrine This includes goiter, hot/cold intolerance, voice changes, changes in body contours, changes in hair patterns, polydipsia, polyuria, and polyphagia.

Gastrointestinal Questions about this system should include appetite; food intolerance; belching; indigestion and relief; hiccups; abdominal pains; radiation of pain; nausea and vomiting; hematemesis; cramping; stool color and odor; flatulence; steatorrhea; diarrhea; constipation; mucus in stools; hemorrhoids; hepatitis; jaundice; alcohol abuse; ascites; and ulcers.

Genitourinary This includes urinary frequency (day and night), changes in stream, difficulty starting or stopping stream, dysuria, hematuria, pyuria, urinary tract infections, impotence, libido alterations, venereal disease, genital sores, incontinence, and sterility.

Gynecologic Ask about gravida/para (pregnancies/live births) and complications, abortions or miscarriages, menstrual history, premenstrual tension, painful or difficult menstruation (dysmenorrhea), bleeding between periods, clots of blood, excessive menses (menorrhagia), frequency, regularity, date of last period, menopause (date, symptoms, treatment), postmenopausal bleeding.

Breasts This includes development, lumps, pain, discharge, and family history of breast cancer.

Musculoskeletal Questions about this system should include trauma, fractures, lacerations, dislocations with decreased function, arthritis, inflamed joints, arthralgias, bursitis, myalgias, muscle weakness, limitation of motion, claudication, and gait.

Dermatologic Inquire about hair or nail changes, scaling, dryness or sweating, pigmentation changes, jaundice, lesions, pruritus, biopsies, piercing, and tattoos.

Head, Eyes, Ears, Nose, Throat (HEENT) Questions should include:

- **Head:** Headache, fainting, vertigo, dizziness, pains in head or face, and trauma
- **Eyes:** Vision, glasses, trauma, diplopia, scotomata, blind spots, tunnel vision, blurring, pain, swelling, redness, tearing, dryness, burning, and photophobia
- **Ears:** Decreased hearing or deafness, pain, bleeding or discharge, ruptured ear drum, clogging, and ringing
- **Nose:** Epistaxis, discharge (amount, color, consistency), congestion, colds, change in sense of smell or taste, and polyps
- **Mouth and throat:** Pain, sore throat, dental pain, dental hygiene history, bleeding or painful gums, sore tongue, lesions, bad taste in mouth, loose teeth, halitosis, dysphagia, temporomandibular joint dysfunction, trismus, hiccups, voice changes, neck stiffness, nodes or lumps, and trauma

Hematologic This includes increased bruising, bleeding problems, nodes or lumps, and anemia.

Family History

Find out what illnesses the patient's grandparents, parents, siblings, and children have/had. If any of these relatives are dead, at what age did they die and what was the cause? Ask about family history of tuberculosis, diabetes, heart disease, hypertension, allergies, bleeding problems, jaundice, gout, epilepsy, birth defects, breast cancer, and psychiatric problems.

Social History

Ask about the patient's home life, education, occupational history (including military, if applicable), family closeness, domestic violence, normal daily activities, financial pressures, sexual relationship(s), recreational drugs use, and tobacco and alcohol history. A good question to ask is "What will you do when you get better?"

History for Pediatric Patients (Infants and Children)

Generally, history taking is similar for a pediatric patient as for an adult patient. However, unlike the adult history, much of the history for a child is taken from the parent or guardian. If the child is old enough, it is a good idea to interview the child as well. There are two basic rules when interviewing children: Do not ask too many questions too quickly, and use age-appropriate language. Special emphasis should be placed on the following areas.

Prenatal and Perinatal History Was the child full term or premature? Were there any complications during pregnancy? What was the perinatal course:

- Hospitalizations: Reasons and dates
- Operations: Procedures and dates, including anesthetic used and any complications
- Allergies: Medications, foods, tapes, soaps, and latex. Include a note on the type of reaction. Be careful to differentiate between true hypersensitivity/allergy reactions and adverse side effects
- Medications past and present: Dose and frequency, prescription and over-the-counter (including topical agents)
- Potential exposure to dangerous or easily transmissible infections: Tuberculosis, venereal disease, hepatitis, flu, HIV, and prion disease (UK)
- Maternal immunizations: Tetanus, rubella, hepatitis
- Transfusions
- Trauma
- Diet while pregnant
- Maternal habits: Alcohol intake, tobacco, and recreational drugs

Postnatal History It is also important to look into:

- Immunization status: Is the child up to date with immunizations?
- Infection: Has the child had recent exposure to childhood infections (e.g., cold, flu, chickenpox, rubella, or mumps) because this may be sufficient cause to postpone elective surgery. Also ask about acute otitis history.
- Nutrition: Was the child bottle- or breastfed? What was the frequency and duration of feedings? At what age was the child weaned? Does the child have any food allergies? Is there any history with fluoride?
- Personal or family history of complications from general anesthesia.
- Growth and development: attainment of developmental milestones (physical, cognitive, social and emotional, speech and language, and fine and gross motor skills).

- School status.
- Significant febrile episodes in early childhood.
- Social history: What is the home environment (e.g., smokers at home, pets, main caregiver)? What are the parental arrangements and custody, sequence of patient among siblings, siblings (number, ages, health status, social arrangements [e.g., living at home])?

Physical Examination

Introduction

Depending on training and dental practice laws, dentists might be responsible for completing a full physical examination when admitting a patient. The admitting dentist will certainly be responsible for the detailed examination of the oral cavity and must be able to interpret the results of the history, physical examination, and laboratory tests. Whenever possible, the physical examination should be completed in a systematic manner, so that nothing is omitted, although physical limitations of the patient might preclude this.

Elements of the Physical Examination

Start the physical examination by giving a statement of the setting in which the examination was performed and a gauge of the reliability of the examination (i.e., whether you were able to perform a full exam).

General Inspection

Note the patient's apparent age, race, sex, build, posture, body movement, voice, speech disorders, nutritional/hydration status, and facial or skeletal deformities or asymmetries.

Vital Signs

- Pulse: If irregular, measure the apical pulse and note its beat as “regularly irregular” or “irregularly irregular.”
- Blood pressure: Take in both arms with the patient sitting, supine, and standing.
- Temperature: Note the site at which the temperature was recorded.
- Respiratory rate.
- Height, weight (for a child record the percentile height/weight).
- Global pain score on a scale of 1 to 10 (1 = no pain and 10 = worst possible pain).

Integument

Note the color/pigmentation, texture, state of hydration (turgor), temperature, vascular changes, lesions, scars, hair type and distribution, nail changes, tattoos, and piercing.

Head, Eyes, Ears, Nose, Throat

- Head: Note the size (normally noted as normocephalic) and palpate for swelling, tenderness, injuries, and symmetry. Take an actual measurement of the circumference in centimeters in children.
- Eyes:
 - Visual acuity: If corrected, the degree should be estimated
 - Periorbital tissues: Edema, discoloration, and ptosis
 - Exophthalmos/enophthalmos
 - Conjunctiva and sclera: Pigmentation, dryness, abnormal tearing, lesions, edema, hyperemia, and icterus
 - Oculomotor: PERRLA (pupils equal, round, react to light and accommodation), EOMI (extraocular movements intact) or gaze restricted, nystagmus, and strabismus
 - Fundoscopy: Optic disc (size, shape, color, depression, margins, vessels), macula, periphery, light reflexes, exudates, and edema
- Ears: Hearing (watch tick, hair manipulation, whisper, Rinne and Weber tests when indicated), external auditory canal, tympanic membranes, mastoids, wax, and discharge
- Nose: Septum (position, lesions), discharge, polyps, obstruction, turbinates, and sinus tenderness to palpation (if necessary, transilluminate)
- Mouth and throat:
 - Lips: Color and lesions
 - Teeth: Hygiene, decayed, missing or filled teeth, mobility, prostheses, and occlusion. Record the developmental status in children (primary, mixed) and whether this is appropriate for the chronological age (Appendix 22).
 - Gingiva: Color, texture, size, bleeding, lesions, and recession
 - Buccal mucosa: Color, lesions, and salivary flow from parotid glands, Stensen's ducts
 - Floor of mouth: Color, lesions, and salivary flow from submandibular/sublingual glands, Wharton's ducts
 - Tongue: Color, lesions, papillary distribution or changes, movement, and taste (if indicated)
 - Hard and soft palate: Color, lesions, deformities, petechiae, and movement of soft palate
 - Oropharynx: Tonsillar pillars, color, lesions, and gag reflex
 - Temporomandibular joint (TMJ): Click, pop, crepitus, tenderness, and trismus from a variety of problems (e.g., infection, micrognathia, scleroderma, arthritis)
 - Muscles of mastication: Tenderness and spasm

Neck

- Lymph nodes: Deep cervical, posterior cervical, occipital, supraclavicular, preauricular, posterior auricular, tonsillar, submaxillary, sublingual, and submental
- Trachea: Position and movement with swallowing
- Thyroid: Size, consistency, tenderness, mobility, masses, and bruits

- Throat/neck: Dysphagia, carotid bruits, jugular venous distention (JVD), and hoarseness
- Cervical spine: Mobility, posture, pain, and muscle spasm

Thorax

- Observation: Symmetry, size, scars, shape, anteroposterior dimension, and respiratory excursions
- Percussion: Resonance or dullness and where located, and tactile fremitus
- Auscultation: Breath sounds, stridor, wheezing, rales, rubs, rhonchi.

Breasts

See Box 1.1.

- Size
- Symmetry
- Lesions
- Stippling
- Discharge
- Masses
- Tenderness
- Tanner stage (in children and adolescents)
- Gynecomastia (in males)

Cardiovascular

- Point of maximal impulse (PMI): Inspect and palpate for PMI, noting location and character, thrills, and heaves.
- Auscultate: Note rate and rhythm (regular vs. irregular), murmurs, friction rubs, gallops, and other abnormal sounds. When indicated, changes in heart sounds with exercise or change of position should be noted.
- Edema: Note location, degree, extent, tenderness, and temperature.
- Arteries: The carotid, superficial temporal (facial), brachial, radial, femoral, ulnar, popliteal, posterior tibial, and dorsalis pedis pulses should be palpated for strength, character, and equality.
- Veins: Note pressure, varicosities, cyanosis, rubor, and tenderness.

Abdomen

- Appearance: Size, shape, symmetry, pigmentation, and scars
- Auscultation: Bowel sounds, peristaltic rushes, and bruits

Box 1.1. Sensible Precautions When Examining a Patient

The breast and genitourinary examinations are routinely deferred. Make sure that a chaperone is present during the examination.

- Percussion: Note borders of organs and fluid, areas of tympany, hyperresonance, dullness or flatness, shifting dullness, and tenderness
- Palpation: Size of the abdominal aorta and pulsations, liver, spleen, kidneys, masses, fluid wave, tenderness, guarding, rebound tenderness, hernia, and inguinal adenopathy

Genitalia (When Appropriate)

See Box 1.1.

Male Note development, penile scars or lesions, urethral discharge, testes descended, hernia, tenderness, masses, and circumcision.

Female

- External examination: Hair, skin, labia, clitoris, Bartholin's and Skene's glands, urethral discharge, vaginal discharge, and lesions
- Internal examination: Cervix, uterus, ovaries (masses, tenderness, lesions), and indication of pregnancy

Anorectal

Record hemorrhoids, skin tags, fissures, rectal sphincter tone, masses, strictures, character of stool, and guaiac stool. In males, prostate size, consistency, nodularity, and tenderness should also be noted.

Extremities

Note proportions (to each other and to entire body), amputations, deformities, finger clubbing, cyanosis, koilonychia, edema, erythema, enlargement, tenderness, range of motion of joints, cords, muscle atrophy, strength, swelling, spasm, and tenderness.

Spine

Note alignment and curvature, range of motion, tenderness to palpation and percussion, and muscle tone.

Neurologic

- Appropriateness; alertness; orientation to person, place, time, and situation; recall for past and present. For adults aged 55 and older whose responses to questions seem inconsistent, the Mini Mental State Exam (MMSE) can be used to check the possibility of dementing illness or other insidious, progressive cognitive impairment that might call into question the patient's ability to provide informed consent and a thorough history. If there is evidence of injury or cortical disease, further tests are indicated.
- Impaired sensorium: Assess the magnitude and degree of as well as the type of neurologic deficit.

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- Meningeal signs (if indicated): Stiff neck, Kernig and Brudzinski signs.
- Cranial nerves: See Appendix 9.

Musculoskeletal

Check for tenderness, swelling or deformities of the joints.

Concluding the Admission Workup and Note

- Assessment (problem list): List the patient's differential diagnosis derived from the history, physical examination, and old records.
- Plan: Include further diagnostic tests, procedures, medical therapies, or surgeries.

Admission Orders

Introduction

Admission orders are generally the first orders written on a patient following admission (Box 1.2). As such, they must include all aspects of the patient's care and comfort, taking into account both the environmental factors and the proposed therapeutic procedures. Orders are a major link between dental and nursing staff in providing patient care. Many needless phone calls can be avoided if the orders are precise, intelligible, and legible. Like any other entry in the chart, they become part of the permanent medical and legal record. They should be signed and dated, and the time should be noted.

Box 1.2. Elements of the Admission Orders

Disposition: Admit to (floor, service, and attending dentist)

Diagnosis (reason for admission): Actual or provisional, other significant medical problems

Condition: Good, fair, poor, and critical are adequately descriptive

Allergies: Allergies of any sort—food or drug—should be included, but specifically you should inquire as to penicillin and other antibiotics, aspirin, codeine, iodide preparations, latex, and surgical tape. Also note any medications contraindicated secondary to concomitant disease(s) or cross-reactivity with other medications

Patient monitoring: Vital signs should be monitored every two, four, and six hours/shift or routine. Specific requests for varying monitoring depend on the patient's condition (e.g., check for stridor, call house officer if temperature is above 101°F (38.5°C))

Activity: Should be consistent with patient's condition (e.g., out of bed ad lib, bathroom privileges, up with assistance, chair, bedrest). For children: Detail the required supervision and restraints (e.g., bed rails, consent for restraints)

Diet: Should be normal, soft, mechanical soft, full liquids, clear liquids, or nil by mouth (NPO; indicate time). Diet can be modified if this is made necessary by concomitant disease state(s) such as diabetes, renal failure, hypertension (e.g., American Diabetes Association 1,500 calories, no added salt [NAS], fluid restrictions, force fluids)

Diagnostic tests: Testing should be determined based on the admission assessment and diagnostic plan. Examples include:

- Routine: Complete blood cell count, differential, electrolytes, prothrombin time with international normalized ratio (INR), partial thromboplastin time, type and hold, or type and crossmatch; sickle screen when indicated
- Electrocardiogram, chest X-ray, and urinalysis
- When indicated: Blood gases, cultures, cytology, endocrine studies, liver enzymes, hepatitis and HIV studies, pulmonary function tests
- Additional X-rays as indicated

Pediatric patients: Complete blood cell count with differential and urinalysis. Sickle screen when indicated. Additional tests should be requested as indicated by medical history and physical examination. Same-day surgery admissions in many hospitals permit a fingerstick hematocrit for well children before elective surgery

IV fluids: Both composition of fluid and rate of infusion should be specified, taking into account existing and potential deficiencies

Medications: For routine medications taken by the patient, the regimen might need to be adjusted according to the present physical status and procedure planned. Also note the medications to be started on admission—dosage and administration schedule

Input: Amount and composition of fluid intake, both PO and IV

Output: Fluid lost from all sources (urine, vomitus, nasogastric tube, fistula, wound drainage). Note: Weight is often followed daily to monitor fluid balance

Consults: Service or individual to whom consult is directed, a brief description of the patient's current medical problem(s), planned procedures and specific information sought

Special procedures

- Monitors: Telemetry
- Foley catheterization
- Ice packs/heat packs: Location, time on/off
- Wound care: Dressing changes, irrigation, and precautions
- Specific preparations for additional tests
- Position of bed (e.g., head of bed elevated 30°)
- Suction/lavage
- Deep venous thrombosis (DVT) prophylaxis: Compression stockings

Precautions: Side rails, seizures, bleeding, respiratory, neutropenia, scissors or wirecutters at bedside, etc.

Overview of Patient Admission Procedures

Admission Arrangements

For elective/scheduled hospitalizations, the admissions office will want to know the patient's name, address, telephone number, mother's or father's (guardian's) name (if the patient is under the age of consent), preoperative diagnosis, procedure to be performed, and whether blood products will be needed. Requests for admission, use of operating room, radiographs, and any necessary laboratory work also should be made at this time.

Patient Contact

Patients should be contacted and told of the admission and surgery dates and the scheduled time for scheduled hospitalizations/surgery. Patients should be advised to continue taking all medications consistent with the anesthesia department's policies and not to stop taking appropriate medications before admission simply because they are "going to the hospital." Once admitted, notes will be written to ensure that the appropriate medications are continued.

Hospital Contact with Patient

If your hospital has a preadmission questionnaire, patients should be asked to complete this and return it to the hospital.

A complete history and physical examination should be performed either on the day a patient is admitted to the hospital or before admission. The requested laboratory procedures will be completed and the results placed in the record while the patient is in the hospital awaiting surgery. The surgical consent form should be completed, explained to the patient, and signed according to hospital policy, if not already done prior to admission. If the patient is judged not to have the capacity to give consent because of intellectual impairment, the agreement of parents or legal guardians must be sought.

Preoperative Considerations

Prophylactic Antibiotics (Secondary Prophylaxis)

Preoperative antibiotics are routinely given before invasive procedures and are performed on some specific medically complex patients. The appropriate national regimen for endocarditis prophylaxis should be followed for patients at risk of developing this life-threatening problem. In the United States, the American Heart Association (AHA) has developed guidelines (Appendix 23, Table A23-1); the United

Kingdom follows the NICE guidelines (Appendix 23, Table A23-2). Because an intravenous (IV) line is typically in place for operating room procedures, and the patient is required to fast before surgery, the IV route is preferred.

Selecting the Anesthetic Technique

Local/Regional Anesthetic

Local/regional anesthetic should be used for minor procedures and as an adjunct to IV sedation or general anesthesia.

Nitrous Oxide/Oxygen

Consider whether the patient is suitable for conscious sedation using nitrous oxide and oxygen.

IV Sedation

IV sedation should be considered for:

- Anxious patients who need a procedure of any magnitude
- Patients who are unresponsive or not cooperative
- Medically compromised patients who need stress reduction

General Anesthesia

General anesthesia should be administered:

- For extensive or very painful procedures
- For patients with a profound gag reflex
- When protection of airway with endotracheal tube is desirable
- When hypotensive anesthesia is necessary

Risk Assessment

Patient-Related

The most critical type of risk is patient-related. A thorough history and physical examination is necessary to ascertain the extent of patient-related risk. Cardiac and respiratory diseases are the greatest causes of increased perioperative morbidity and mortality. Be aware of the increasing use of medications, including complementary (e.g., St John's wort), which might interfere with blood coagulation or produce other drug reactions. Appropriate laboratory studies should be obtained to adequately evaluate clinical findings preoperatively.

The American Society of Anesthesiologists (ASA) classification of physical status is the most common form of preanesthetic risk assessment (Appendix 6, Table A6-1).

Procedure-Related

Dental and oral/maxillofacial surgical procedures are typically associated with minimal morbidity or mortality. The treatment of severe infections with airway compromise and the management of maxillofacial trauma carry the highest risk.

Anesthesia-Related

Recent advances in anesthetic monitoring equipment and techniques have reduced anesthetic-related morbidity and mortality. The most common risks include aspiration and other airway disturbances, hypo-/hypervolemia, and human error. Rare, but important, risks also include malignant hyperthermia, dysrhythmias, seizures, myocardial infarction, and hepatitis.

Provider-Related

Complications tend to decrease with practitioner experience and institutional experience. Outcomes assessment is necessary to ensure that the highest quality of care is given.

Laboratory Studies

As a requirement for admission to many hospitals the patient will need to undergo:

- Hematocrit to check for anemia
- Pregnancy test for females of childbearing age. Urine human chorionic gonadotropin (hCG) is the most commonly used test. It is less expensive than others, but also less sensitive. Serum quantitative hCG is more sensitive in very early pregnancy but more expensive
- Urinalysis

Other commonly requested tests based upon history and physical evaluation are shown in Box 1.3.

Box 1.3. Common Tests for Hospital Admission

Most hospitals have established criteria for preoperative laboratory screening, which must be followed. Common tests include:

- Complete blood count (hemoglobin, hematocrit—not always necessary for healthy children—leukocyte count, platelet count): Anemia, infection, immune status, platelet deficiency
- Coagulation studies (e.g., prothrombin time/international normalized ratio [INR])
- Serum electrolytes (Na, Cl, K, CO₂, BUN, Cr, glucose): Metabolic disturbance (e.g., kidney failure, diabetes)
- Toxicology screen: Drug use, levels of seizure medication
- Blood for typing if there might be a need for transfusion

- Urinalysis: Urinary tract infections, hydration, kidney function
- Liver function tests: Alanine aminotransferase (ALT), aspartate aminotransferase (AST), lactic dehydrogenase (LDH), bilirubin, and alkaline phosphatase
- Posterior/anterior and lateral chest radiographs: Cardiopulmonary anomalies (e.g., pneumonia, pulmonary edema)
- Electrocardiogram: Dysrhythmia, conduction abnormalities

Prevention of Aspiration

Patients undergoing IV sedation or general anesthesia should not consume anything by mouth (NPO) within a specified number of hours prior to anesthetic induction, depending on institutional policy and the age of the patient. See Box 1.4, below. You must ensure that these instructions have been strictly followed by questioning the patient before going to the operating room (OR). An empty stomach decreases the gastric volume and hence the risk of aspiration.

Pulmonary Embolism Prophylaxis

The risk of venous thromboembolism (VTE) and potential life-threatening pulmonary embolism depends on both surgical (length of procedure, degree of immobilization) and patient-specific (age, comorbidity, hypercoagulable state) variables. Patients are stratified into surgical risk groups based on these variables. Every hospital should have a formal written thromboprophylaxis policy based on the most recent

Box 1.4. Elements of the Preoperative Summary

General statement: For example, “Healthy, 16-year-old intellectually impaired male admitted to (give the location) for (name the procedure or reason for admission).”

Diagnosis: List all current medical problems.

Physical examination: Indicate whether this was within normal limits or if there were abnormalities.

Vital signs

Allergies

Chest X-ray: Pertinent findings should be noted. If the film is clear, no active disease should be indicated.

Electrocardiogram: Note rate, rhythm, and any abnormalities.

Chemistries: Note results and any abnormalities.

Complete blood cell count: Note results and any abnormalities.

Sickle screen: Results should be noted, and if positive, electrophoresis requested to determine the percentage hemoglobin S.

Prothrombin time/international normalized ratio (INR) and partial thromboplastin time: Note results and any abnormalities.

Urinalysis: Note results and any abnormalities.

Operative consent: Must be signed and in chart.

Blood: If blood replacement is anticipated, the number of units requisitioned should be indicated and whether for type and hold or type and cross.

Plan: For example, “To OR in a.m. for full-mouth rehabilitation.”

national guidelines. It is important to be familiar with the practices of your hospital.

- Low-risk patients: Thromboprophylaxis is not recommended for low risk patients.
- Moderate- and high-risk patients: Unless contraindicated, low molecular weight heparin (LMWH), low dose unfractionated heparin, or fondaparinux should be used according hospital policy. When anticoagulation is contraindicated, mechanical thromboprophylaxis with pneumatic or elastic stockings should be used.

Prevention of Adrenal Crisis

Patients who have been or are currently on systemic steroids may be at risk for an adrenal (Addisonian) crisis during or after a stressful event such as a surgical procedure or general anesthetic. The issue of prophylactic steroids prior to dental procedures is controversial, and the risk of an adrenal crisis in the dental setting is unknown. Keep in mind that topical and other nonparenteral sources of steroids can suppress adrenal function if prolonged and/or of sufficiently high dosage. Also, the likelihood of clinically significant adrenal suppression varies with the individual, and no reliable “cookbook” formula (e.g., rule of twos) exists to help the clinician. Adrenal crisis in the dental setting is extremely rare and steroid supplementation is often given because it is easy, inexpensive, and nonthreatening to the patient, in comparison with the potential outcome from an adrenal crisis.

Preoperative Note

Introduction

The preoperative note is a summary of the patient’s general status and laboratory results. It is entered in the progress notes the night before surgery. Abnormal laboratory values should be assessed and orders and notes revised accordingly. Some hospitals combine the preoperative and admission notes in day-surgery cases.

Preoperative Orders

Definition

The preoperative orders are written the night before surgery to prepare the patient for surgery (Box 1.5).

Elements

Different institutions have different policies. Be familiar with your own.

Box 1.5. Elements of Preoperative Notes and Orders

- NPO status (see Box 1.6)
- Radiographs to be taken if not already done
- Steroids/antibiotics on call to operating room
- Blood sample to blood bank: Type and hold or type and crossmatch and number of units if need for blood products is anticipated
- Medical consults
- Consent if not already taken
- Medication:
 - Sleeping pill, if necessary
 - Analgesics, if necessary
 - Premedication: Depending on the hospital, the house officer might write these or they might be per the anesthesiologist

Box 1.6. Preoperative Fasting Schedule

Age	Solid, nonclear liquids, infant formula, nonhuman milk	Breast milk	Clear liquids
Children older than 36 months and adults	6–8 hours	4 hours	2 hours
Children age 6–36 months	6–8 hours	4 hours	2 hours
Children less than 6 months	4–6 hours	4 hours	2 hours

Intraoperative Considerations***Positioning the Patient***

1. The patient should be placed in the reverse Trendelenburg position with the head elevated 10° to 20° to prevent pooling of blood in the face (Appendix 21).
2. Eye protection should be provided by the placement of ophthalmic ointment, taping the eyelids closed or using ocular occluders, and placement of gauze eye pads.
3. The endotracheal tube is secured using tape so that the head can be turned from side to side without extubation. A simple technique, if the patient is nasally intubated, involves taping the tube to the skin of the bridge of the nose and forehead with silk or cloth tape (benzoin application can improve adherence) and placing a folded pillowcase turban around the head and securing the tube over the top of the head. Nasal intubation is generally preferred for most

intraoral procedures and is desirable if the patient needs to have bite-wing X-rays taken or the occlusion checked or if maxillomandibular fixation is required during the procedure. Nasal intubation is contraindicated if the patient has epidermolysis bullosa, severe coagulopathy, nasopharyngeal carcinoma, or nasal obstruction.

4. The height of the operating table is adjusted so that the operating field is at elbow level. A count is made of sponges, sharps, etc., at the beginning of every surgical procedure.
5. The patient's arms should be tucked along his or her side so that they do not dangle over the side of the table. Foam padding should be placed under the arms and feet to prevent pressure injury. A "donut" or headring can be placed under the head to minimize movement.

Prepping and Draping

Surgical Preparatory Scrub Solutions

- Iodine-containing compounds: check for allergy first
- Chlorhexidine
- Alcohol

Technique of Mucosal and Skin Preparation

1. Suction the oropharynx.
2. Place a moistened throat pack (with radiopaque marker) into the oropharynx by layering.
3. Some clinicians brush the teeth and bathe the oral tissues with iodine or other antibacterial compound (this is optional, depending on the procedure).
4. Cleanse the face by applying prep solution in an expanding circular, nonoverlapping fashion at least three times, each time with a different sponge. When applying the scrub solution, take care not to pass the same sponge over the area more than once. Be careful when applying surgical prep solutions around the eyes. Only dilute iodine compounds are tolerated by the ocular tissues.

Draping for Orofacial Surgical Procedures

Place sterile towels or paper drapes around the operating field. Then use a larger sterile drape to cover the entire patient except for the operative field. A thyroid drape is usually ideal for intraoral procedures or those involving a segment of the face. Other styles of sterile drapes can be useful depending on the amount of surface area needed in the operating field.

Use of Local Anesthetic

Consider discussion in situations when there might be a contraindication (e.g., epinephrine and severe aortic stenosis).

Type To provide the most profound anesthesia and minimize the amount of endogenous catecholamine released, use a regional block when possible, using a long-duration local anesthetic with vasoconstrictor. When proper aspiration is performed, there are few contraindications to local anesthetics containing a vasoconstrictor. In the past, epinephrine-free solutions have been recommended for use when treating “cardiac” patients. However, without epinephrine, the level of anesthesia is inadequate. The resultant pain response stimulates endogenous secretion of norepinephrine, which could have the same cardiac effects as a local anesthetic with vasoconstrictor. Therefore, short-acting local anesthetic agents without vasoconstrictor should be avoided except in cases where there is a clear contraindication, such as left ventricular outflow obstruction (e.g., hypertrophic subaortic stenosis, aortic valve stenosis). If using local anesthetic for pain control, with or without IV sedation, choose a local anesthetic agent that will provide profound anesthesia well into the postoperative period.

Profound local anesthesia will reduce the amount of general anesthetic agent needed. Consider giving additional regional blocks prior to emergence from general anesthesia to decrease postoperative discomfort.

Local anesthetic with vasoconstrictor is frequently infiltrated in the surgical site, principally to control bleeding. Exercise caution in very young or intellectually impaired patients, who might inadvertently self-mutilate soft tissues during the recovery period. The use of approved injectable form of phentolamine mesylate for the reversal of anesthesia of the lip and tongue and associated functional deficits may be considered if self-mutilation is a concern.

Quantity The maximum dose of lidocaine to limit systemic toxicity is 4.4 mg/kg, but is elevated to 7 mg/kg if epinephrine is used. The dysrhythmic threshold for submucosal epinephrine is different depending on which inhalational agent is being used: 2 mcg/kg for halothane; 6 mcg/kg for desflurane, isoflurane, and sevoflurane; and 18 mcg/kg for ethrane. Halothane and ethrane are now rarely used due to the introduction of these newer agents. Always aspirate prior to injection to avoid a large intravascular dose of local anesthetic and/or vasoconstrictor. Notify the anesthesiologist of the dose and the percentage of epinephrine prior to injection.

Block vs. Infiltration If vasoconstrictor is used, the area of the surgical procedure could be infiltrated to decrease bleeding. If the local anesthetic is given for analgesia, a regional block might be more desirable.

Sequence of Surgical Procedures

The sequence in which procedures are performed depends on the particular case. With the advent of antibiotic usage, rigid internal fixation, and other technical improvements, many of the old sequencing rules no longer apply. However, it is important that the presurgical preparation includes not only the types of procedures to be performed, but also an order in which they will be done. Every case must be treated individually.

Operative Notes

Introduction

Operative notes are a detailed summary of the surgery, preferably dictated or written immediately postoperatively before leaving the operating room (OR) suite (Box 1.7).

Box 1.7. Elements of Operative Notes

Patient data: Doctor (first and last names) dictating an operative report on (patient's name, hospital number). Patient's hospital location, service performing the surgery, and date of operation should be included

Preoperative diagnosis

Postoperative diagnosis

Operation performed

Surgeon(s) and assistant(s)

Anesthesia: For example, "Inhalation anesthesia with nasotracheal intubation"

Indications for operation: a succinct history of present illness. For the healthy child, give behavior history

Description of procedure:

- introduction of anesthesia: smooth, stormy, tube in place
- Prepping and draping of surgical site
- Type of incision, steps in incision
- Tissue removed: Description of tissue
- Pathology report (if any): Disposition of any tissue removed (e.g., "teeth sent to pathology for gross only" or "tissue sent for preparation and histologic examination")
- Irrigation solutions
- Closure: Steps and specific material used
- Packs, drains, tubes, and dressing placed (including throat pack)
- IV fluids
- Intraoperative medications, other than those used by the anesthesiologist (e.g., antibiotics, steroids)
- Surgery: When the procedures done include operative dentistry, a description of procedures should include condition of the teeth and oral cavity. All procedures should be noted (e.g., examination, scaling, four periapical radiographs). Restorations should be described by tooth restored and material used (e.g., teeth number 3, 12, and 18 were restored using occlusal amalgams over CaOH₂ liner). Some hospitals permit the use of universal numbering systems in medical records, whereas others require use of the full name of the tooth (e.g., "tooth number 3" vs. "maxillary right permanent first molar")

Blood: Estimated blood loss (EBL) and hematosis at completion of surgery

Fluid replacement

Complications

Status on arrival in the recovery room: State of consciousness, with or without respiratory assistance, intubated or extubated in operating room, etc.

Brief Operative Note

Definition

The brief operative note is a short note written in the medical records immediately following surgery (Box 1.8).

Box 1.8. Elements of a Brief Operative Note

- Preoperative diagnosis
- Postoperative diagnosis
- Operation performed
- Surgeon
- Anesthesia
- Estimated blood loss
- Fluid replacement
- Complications
- Condition

Postoperative Orders

Definition

Following surgery, all previous orders are considered cancelled. Hence, postoperative orders, such as admitting orders, must consider all aspects of patient care and comfort (Box 1.9).

Box 1.9. Elements of Postoperative Orders/Requests

Disposition: Admit to (location) via recovery room

Diagnosis

Procedure

Condition

Allergies

Patient monitoring: Indicated frequency of checking of the vital signs by the attendant nursing staff. The usual routine is every 15 minutes for the first postoperative hour, then every half hour until fully awake from anesthesia, followed by every hour for 4 hours and then per routine, if the patient's condition is stable

Diet: Postoperative—clear liquids to full liquids as tolerated

Activity: Ambulation as soon as possible following surgery is helpful in clearing secretions from the bronchial tree. It also helps to prevent thrombophlebitis. Toward this latter end, the use of elastic stockings is a routine postoperative procedure in some hospitals. The level of supervision should be specified, especially for children and patients who are intellectually impaired

(Continued)

Physiotherapy: Until the patient is ambulatory, turning, deep breathing, and coughing (unless contraindicated) are helpful in clearing the bronchial tree of secretions

Respiratory assistance: Consider respiratory assistance in the immediate postoperative period when respiratory efforts are still depressed secondary to anesthesia and for pain. If an inhalation anesthetic was employed, and the patient is still expiring the gases, supplemental oxygen is probably necessary and can be requested as 40% O₂ via facemask or tracheal collar to prevent hypoxia. Depending upon the patient's respiratory status, an incentive spirometer can be requested

Daily weights

Input and output

Voiding: The patient with adequate fluid intake, either PO or IV, and adequate renal function can be expected to void within six to eight postoperatively. If a catheter was placed, a flow of 30 to 60 mL/hour is adequate. The house officer should request notification if the patient fails to void or if the rate is significantly decreased

Tubes, catheters, drains, packs: Type, location, number, and care should be specified

Bedside equipment: Ice, Vaseline®, suction, wire cutters, or tracheostomy set

Monitors

IV fluids: For example, "Continue type of solution at 75 mL/hour until patient is taking fluids PO, then DC"

Medications: Preoperative medications are resumed when appropriate. Adequate analgesia is important in the postoperative period; too little can result in hyperventilation secondary to splinting, and too much can depress respiration at the central nervous system level. Antibiotics, antiemetics, and antipyretics can be added. Avoid the tendency to undermedicate children, who tend to be more pain sensitive than adults

Unusual conditions: Notify the house officer (e.g., blood pressure above 150/100 mmHg or below 90/60 mmHg, temperature above 101°F (38.5°C), pulse below 60 or above 120 bpm, oral bleeding, protracted nausea and vomiting)

Elements

The elements of postoperative orders are essentially the same format as for admission orders.

Antibiotics

Infected Wounds

Surgical principles for the removal of the etiologic agent and adequate drainage are of foremost importance. All infected wounds should be Gram stained and cultured for aerobes and anaerobes, and antibiotic sensitivities should be determined. However, the culture and sensitivity results usually take days and these infections must be treated empirically until precise information is available from the microbiology laboratory. Modification of antibiotic dosages according to body weight

(g/kilogram) is required for children. Modification of antibiotic dosages also may be required in the setting of decreased creatinine clearance.

Penicillin The drug of choice for most infected wounds in the oral cavity in adults is penicillin VK which covers Gram-positive aerobes and anaerobes (Appendix 12, Table A12-4). Bacterial resistance due to production of beta-lactamase is increasing. If this is a concern, IV or intramuscular (IM) Unasyn® (ampicillin sodium/sulbactam sodium) may be prescribed.

Metronidazole Metronidazole can be added to the therapeutic regimen to provide more anaerobic coverage and wound penetrance (Appendix 12, Table A12-4). Caution the patient against consuming ethanol when taking this medication because this can cause severe nausea and vomiting and profound hypotension.

Cephalexin The low risk notwithstanding, it is safest to avoid cephalosporins in pen-allergic patients unless absolutely necessary.

Erythromycin Erythromycin can be used in penicillin-allergic patients. It provides similar coverage to penicillin (Appendix 12, Table A12-4). When given IV, erythromycin can cause burning at the IV site and phlebitis. Common side effects include abdominal pain, nausea, and diarrhea. Erythromycin also has a number of drug interactions that should be considered prior to its use.

Clindamycin Clindamycin is a broad-spectrum antibiotic that can be used in penicillin-allergic patients (Appendix 12, Table A12-4). It is also useful for infections containing penicillin-resistant organisms. Clindamycin has been implicated in the development of *Clostridium difficile* infection although alternative antibiotics also have been shown to cause this problem. *C. difficile* infection can manifest with symptoms ranging from fever, abdominal pain, and bloody diarrhea to frank pseudomembranous colitis. Often there is a concomitant leukocytosis. If a patient develops any symptoms suspicious of *C. difficile* infection, it is important to test for the toxin and begin empiric therapy with oral metronidazole. Oral vancomycin is also used in complicated cases.

Non-Infected Wounds

Prophylactic antibiotic coverage should be continued intraoperatively and postoperatively until the IV line is discontinued. Continuation of antibiotic therapy might be indicated via the PO route if the patient has a grossly contaminated wound, an unusually extensive operation, placement of a bone graft, or a compromised immune status. PO antibiotics are administered to endocarditis susceptible patients according to the AHA guidelines (Appendix 23, Table A23-1).

Fluid management

The management of fluids is outlined in Appendix 15 (Boxes 1.10 and 1.11).

Box 1.10. Physical Assessment of Fluid Balance**Mental status:** Confusion, dementia**Vital signs:** Temperature, pulse, respiratory rate, blood pressure (sitting, lying)**Cardiovascular:** Jugular venous distention, heart sounds**Lungs:** Clear or congested**Skin:** Turgor**Box 1.11. Laboratory Tests****Electrolytes****Hemoglobin/hematocrit****Urinalysis:** Specific gravity**Types of Intravenous Fluid**

The different types of intravenous fluid are outlined in Appendix 15, Table A15-2.

Potassium

Abnormal levels of serum potassium can have an adverse effect on cardiac muscle function.

Hyperkalemia

Hyperkalemia is a potentially life-threatening metabolic abnormality. Clinical signs include confusion, weakness, and hyperreflexia. Electrocardiogram (ECG) changes include peaked T waves, decreased R waves, and a prolonged QRS complex. It is commonly treated with calcium chloride 1 g IV, followed by 25 g dextrose 50% in water IV, 5 to 10 units regular insulin IV, and by sodium polystyrene sulfonate (oral or enema). Sodium bicarbonate 1 mEq/kg IV also may be given.

Hypokalemia

Hypokalemia is more commonly encountered than hyperkalemia. Clinical signs include weakness, anorexia, and nausea. When appropriate, repletion should generally be performed by slow administration IV or PO.

Acid–Base Balance

See above. Conditions that affect the acid–base balance are outlined in Appendix 2.

Water Intoxication

Water intoxication is usually of iatrogenic origin as a result of fluid overloading in the perioperative period. Clinical signs include polyuria, soft tissue edema, pulmonary edema, confusion, and seizures associated with hyponatremia. It is treated by

water restriction with or without diuretic administration. Hypertonic saline solutions generally should not be given because rapid administration can lead to central pontine demyelination.

Syndrome of Inappropriate Antidiuretic Hormone Secretion (SIADH)

In SIADH, usually following head trauma, excess water is retained. The clinical signs are similar to those of water intoxication. This problem is treated by water restriction and administration of normal saline. If hyponatremia persists without volume excess, hypertonic saline can be administered slowly and carefully.

Diet

Patients and their families should be made aware of dietary alterations that might be experienced as a result of the surgical procedure (Appendix 11). The importance of maintaining adequate dietary intake for normal recovery should be stressed. Minimum daily requirements during convalescence include 160g of protein and 3,000 non-protein calories. The patient also should be encouraged to drink 3L of fluid/day. Dietary supplements are often helpful in providing adequate nutrition during the immediate postoperative period.

Although maxillomandibular fixation is rarely necessary since the advent of rigid internal fixation, some patients undergoing orthognathic surgery or treatment of facial fractures will have their teeth wired together. These patients are at particular risk for nutritional disturbance. Use of a blender to puree food will allow for ingestion of a broader variety.

Pain Management

Postoperative pain management can begin before leaving the operating room by giving small amounts of IV morphine, giving 30 mg ketorolac tromethamine IV, and by administering regional/local anesthetic nerve blocks with bupivacaine. Postoperative pain can be managed according to hospital policy because there may be regional and hospital-specific variations. Commonly a combination of basal non-steroidal anti-inflammatory drugs (NSAID) and opiate therapy is used with short-acting opiate dosing for breakthrough pain (Appendix 12, Table A12-4). Patients should be encouraged to abandon IV or IM medications for PO pain management as soon as possible. In small children, intra- or postoperative morphine can delay discharge.

Control of Edema

Nonpharmacologic techniques for control of edema include:

- Elevation of the head
- Head dressings
- Ice packs (for a maximum of 12 hours).

Pharmacologic methods rely on the corticosteroid dexamethasone: 10 mg PO (at least one hour prior to surgery) or 4 to 12 mg IV before the procedure. However, corticosteroids should not be used in patients with chronic infections, peptic ulcer disease, renal insufficiency, gastritis, severe cardiovascular disease, or diabetes.

Management of Perioperative Complications

Nausea and Vomiting

Anesthetic agents and swallowing blood can precipitate nausea. Nasogastric suction immediately before the patient emerges from general anesthesia can be beneficial if considerable ingestion of blood is suspected. Antiemetic medications also can be used (Appendix 12, Table A12-4).

Fever

If the temperature is below 100°F (38.5°C), the patient can be treated empirically with acetaminophen (Tylenol®) 1 g PO or PR and fluid, deep breathing, and ambulation.

If the temperature is above 100°F (38.5°C), treat as above and consider using chest physical therapy (PT) and incentive spirometry if atelectasis is a possible cause.

Workup of Fever

1. Inspect wounds, IV sites, and skin for inflammation, purulent drainage, abscess, or rash.
2. Perform pulmonary auscultation for diminished lung sounds or rales.
3. Use chest radiograph to rule out atelectasis, pneumonia, aspiration, or pulmonary edema.
4. Perform urinalysis and urine culture.
5. Perform blood cultures for recurrent or persistent high-grade fever.

Hypertension

The causes and treatment of post-operative hypertension are discussed in Chapter 6.

Airway Compromise/Decreased Oxygenation

Upper airway obstruction should be treated with a nasal decongestant, for example xylometazoline (Afrin®). If severe, obstruction of the nasopharyngeal airway might require reintubation or tracheostomy (if unable to reintubate). Decreased oxygenation also can be caused by:

- Atelectasis
- Aspiration pneumonitis
- Pulmonary edema
- Pulmonary embolism

- Pneumothorax
- Asthma or bronchospasm
- Mucus plugging

Oliguria

Oliguria is a decreased output of urine and may be a sign of dehydration, renal failure, hypovolemic shock, hyperosmolar hyperglycemic nonketotic syndrome, multiple organ dysfunction syndrome, urinary obstruction/urinary retention, and urinary tract infections. Assistance should be given to any patient who has been unable to void within 12 hours of surgery. In the postoperative, postgeneral anesthetic period the nonretention causes mentioned above should first be ruled out. Symptoms are suprapubic fullness and the urge to urinate.

Treatment of urinary retention subsequent to an anesthetic is by:

- Assisted ambulation
- Heat packs to the suprapubic region
- Straight catheterization

As mentioned above, a urinalysis should be performed to rule out other causes. Volume depletion, urinary tract infection, and renal failure are also potential causes of oliguria and should be considered in the patient whose bladder is empty when catheterized. Renal ultrasound, urinalysis, urine electrolytes, and serum creatinine can be used to evaluate the underlying cause(s).

The Postoperative Note

Definition

The postoperative note is a short note discussing the status of the patient the evening of surgery (Box 1.12). It is usually in a “SOAP” format: subjective, objective, assessment and plan.

Box 1.12. Elements of Postoperative Notes

Subjective: Patient report of status (e.g., pain, swelling, limited movement, drainage, bleeding, etc.)

Objective:

- Vital signs
- Neurologic status: Awake, alert
- Wound condition: Draining, oozing, dry
- Respiratory status: Auscultation results
- Input/output: e.g., diet, vomiting, voiding

**Assessment
Plans**

Follow-Up Notes

Definition

Follow-up notes are brief comments concerning patient status and plans for treatment (Box 1.13).

Box 1.13. Elements of Follow-Up Notes

Subjective: Patient report of status (e.g., pain, swelling, limited movement, drainage, bleeding, etc.)

Objective:

- Vital signs
- Neurologic status: Awake, alert
- Wound condition: Draining, oozing, dry
- Respiratory status: Auscultation results
- Input/output: e.g., diet, vomiting, voiding

Assessment/Plan/Suggestions: Continuation or change in treatment (e.g., diet, rinses, medications, exercises, etc.)

Discharge Notes and Requests

A sample of a discharge note appears in Box 1.14.

Box 1.14. Discharge Notes and Requests

Discharge diagnosis: All diagnoses should be noted

Operation or procedure

Condition

Medications: Prescriptions for antibiotics and analgesics should be included

Discharge time

Home care instructions

Follow-up appointment: Time, place, telephone number

Discharge Summary

Introduction

As well as writing an order in the chart that the patient is to be discharged, a discharge summary must be dictated (Box 1.15). If this is a day surgery case there is no need for a discharge summary.

Box 1.15. Elements of a Discharge Summary

Patient data:

- Name
- Medical record number
- Service/procedure/operation
- Date of admission
- Date of discharge
- Attending physician/dentist

History:

- Patient's age
- Number of admissions to this hospital
- Symptoms and past treatment, if any
- Pertinent past medical history
- Pertinent review of systems
- Pertinent family history
- Allergies

Past medical history: Anything that has not already been covered

Physical examination: Positive findings only

Laboratory data: Positive findings only

Hospital course: Positive findings only

Discharge diagnosis

Operations or procedures performed

Complications

Medications on discharge: Dosage should be included

Condition on discharge

Disposition: Follow-up care should be noted

Estimated disability

Clinical Course

There might be a clinical course summary to be completed and placed in the chart prior to discharge. This is a fill-in-the-blank, very abbreviated discharge summary that, among other items, lists the person responsible for dictating the more detailed discharge summary.

Examples of Hospital Charts

The hospital charts in Appendix 19, Table A19-1, show how to record the history and physical examination; orders; consult requests; and progress, operative, and discharge notes. The correct required paperwork, forms, elements of the medical record, and orders will vary from one hospital to another. Short-stay or same-day admissions (day surgery) are increasing, especially for elective surgery, and hospitals often abbreviate chart entries to allow for the short duration of the stay. Admission and preoperative notes are sometimes combined, as are admission and preoperative

orders. A discharge note might suffice instead of a discharge summary for a short hospitalization, recounting the entire hospitalization.

Examples of Emergency Room Admissions

Appendix 19, Table A19-2, gives examples of emergency room admissions.

Suggested Reading

- Bickley LS, Hoekelman RA, Bates B (Eds.). *Bates' Guide to Physical Examination and History Taking*. Lippincott, Williams and Wilkins, New York. 2008.
- Haug RH. Selecting the Appropriate Setting for Management of Maxillofacial Trauma. *J Oral Maxillofac Surg* 57:983–989, 1999.
- Miloro M, Ghali G, Larsen P, et al. (Eds.). *Peterson's Principles of Oral and Maxillofacial Surgery*. PMPH USA, Hamilton, ON, Canada. 2004.

2

Outpatient Management of the Medically Compromised Patient

Perhaps the most challenging responsibility for a dentist is to provide care for medically complex outpatients. A thorough history is necessary to establish the existence and nature of any medical problems to adequately assess risk, anticipate complications, and decrease the likelihood of medical emergencies while providing appropriate dental treatment.

Medical History

History taking should elicit information about specific medical conditions, previous hospitalizations, surgeries, allergies, medications, and physician visits in recent years. A thorough social history including drug, tobacco, and alcohol use; sexual history; and social support system should also be included. Standard health questionnaires will often bring out significant information in the history but should not be relied upon as the sole source of information, due to inaccuracies in completing such questionnaires or omissions, intended or otherwise. They should therefore be used as a starting point for a more thorough verbal history (Box 2.1).

This chapter is a review (in alphabetical order) of medical problems that are of potential concern to dentists, with emphasis on the essential elements in the medical history, principles of medical care, and oral health care management considerations.

Box 2.1. Example of a Standard Verbal History Taking Format and Content

Hospitalizations: Dates, reason(s) for admission, and outcomes

Operations: Dates, reason(s) for surgery, and outcomes

Drug allergies: Nature, duration, frequency

Medications: Drugs of particular concern

- Oral contraceptives: Reported decreased contraceptive effectiveness with some antibiotics and/or antifungals
- Immunosuppressive drugs: Steroids, cancer chemotherapy, organ anti-rejection drugs
- Antibiotics, antifungals, antivirals: Need to consider the effect on the oral flora and the risk of superinfection
- Nonsteroidal anti-inflammatory drugs (NSAIDs): This category includes aspirin because of its effect on platelet function, although there is no clear evidence that this is clinically important with regard to bleeding during dental procedures

Allergy to Drugs

A drug allergy is an adverse immunologic reaction to a drug (Appendix 3 and Appendix 6, Table A6-2).

Classification

Immunologic drug reactions can be divided into four categories:

- Type I: Immediate in onset and caused by IgE-mediated activation of mast cells and basophils
- Type II: Delayed in onset and caused by antibody- (usually IgG) mediated cell destruction
- Type III: Delayed in onset and caused by immune complex (IgG: drug) deposition and complement activation
- Type IV: Delayed in onset and T-cell-mediated

The World Allergy Association defines two types of immunologic drug reactions:

- Immediate reactions, occurring within one hour of the last administered dose
- Delayed reactions, occurring after one hour but usually more than six hours and occasionally weeks to months after the start of administration

Significance of the Problem

- Type I reactions imply the risk of immediate and life-threatening reactions (anaphylaxis).

- True allergic reactions to local anesthetics are rare, and they represent less than 1% of all adverse local anesthetic reactions. They may be Type I.
- First exposure to a drug can result in an immediate type (Type I) reaction.
- Anaphylaxis may occur with parenteral administration and can last longer if the allergen is administered orally.

Significant Elements in the History

- Sensitivity to any medications/drugs, foods, or materials such as latex, which can cause itching, rash, swelling, or breathing difficulties. Patients should be asked about details of prior experience with specific drugs that might be used in the course of dental treatment (e.g., antibiotics, opioids, aspirin-containing compounds, anesthetics).
- Risk factors include prior history of allergic drug reaction, recurrent drug exposure, certain disease states (e.g., Epstein-Barr virus [specifically amoxicillin], AIDS), atopy (allergic asthma or food allergy) (Appendix 12, Table A12-1).

Evaluating a Patient with a Suspected Allergic Reaction

See Appendix 3. Determine:

- Nature of the allergy
- Previous history of drug allergy and the therapy: drugs administered and the response to them
- Was this the first exposure to the drug? What other medication(s) were taken at the same time (need to exclude drug interaction)?
- Route of administration and dosage: Exclude overdoses or known adverse side-effects (e.g., nausea and vomiting with opioids)
- Time sequence: How soon after injection/ingestion exposure did the allergic reaction occur?
- Be aware of common drugs with significant allergic potential, and alternative medication(s)
- Allergy to local anesthetics must be qualified:
 - Procaine: Allergic reaction is more likely than to other anesthetics but procaine is rarely used in contemporary dental practice
 - Lidocaine: Allergic reaction can occur but it is extremely rare. A preservative is usually the cause
- Signs and symptoms: Rash/hives, syncope, tachycardia, peripheral vasodilatation, loss of consciousness, breathing difficulty or anaphylaxis
- Take both supine (lying down) and sitting blood pressures
- Use a stethoscope to auscultate the trachea for stridor (i.e., high-pitched wheezing sound) and the lungs for bronchospasm (wheezes)
- Examine the skin for urticaria (hives or rash); examine the mouth and oropharynx for angioedema

- After the nature of the allergy has been determined, it is important to differentiate it from other known drug-related side-effects, such as syncope, gastrointestinal upset, and overdose
- Although many reactions to drugs and foods are not true allergies, do not expose a patient to a substance identified as a possible allergen in a non-hospitalized, uncontrolled setting without access to appropriate resuscitation drugs, equipment, and personnel.

Dental Considerations

- Less than 20% of patients react to the offending drug when challenged. For example, most patients with penicillin allergy lose sensitivity after ten years
- Local anesthetic reactions are most often from intravascular injection, toxic overdose, psychogenic reaction, or an idiosyncratic event
- In cases of documented or suspected allergy, patients should be referred for testing and/or desensitization by an experienced clinician before exposure to the drug in the dental office

Bleeding Disorders

Significant Elements in the History

The past medical and family history can help determine whether the bleeding disorder is the result of an inherited or an acquired problem. Also ask the patient about:

- The details of prolonged bleeding after previous surgery (especially tooth extraction, tonsillectomy, and adenoidectomy). This will help differentiate between local factors and a systemic problem
- Spontaneous bleeding (e.g., nosebleeds, heavy menstrual bleeding, hematuria)
- Easy bruising, petechiae or hematoma formation, or bleeding into joints
- Anticoagulant medications (e.g., warfarin, aspirin, and other antiplatelet drugs)
- Liver, renal or bone marrow disease, or underlying malignancy
- Alcohol or injection drug use
- Significant exposure to radiation, benzene, cytotoxic chemotherapy, insecticides, or other relevant chemicals
- Malabsorption syndrome

Evaluating for Bleeding Disorders: Laboratory Tests

See Appendix 7.

- The three initial screening tests for patients with a bleeding diathesis are platelet count, prothrombin time (PT), and activated partial thromboplastin time (aPTT).

- A normal platelet count, normal PT, and prolonged aPTT are characteristic of hemophilia A, hemophilia B, and heparin therapy.
- The PT/international normalized ratio (INR) assesses the extrinsic pathway of clotting (Factors I, II, V, VII, IX, X).
- The aPTT assesses the intrinsic coagulation pathway (prekallikrein, high-molecular-weight kininogen, Factors XII, XI, IX, VIII) and final common pathway (Factors II, V, X, and fibrinogen) and monitors heparin therapy.
- Platelet count is a quantitative measure of platelets.
- Bleeding time is used to characterize platelet function; however, this test is a poor predictor of oral bleeding and has little (if any) value in dental practice.
- The platelet function assay (PFA) test measures platelet dysfunction (adhesion and aggregation) with greater sensitivity and reproducibility than bleeding time. However, this test is nonspecific and should not be used for general screening purposes without knowledge of other variables that influence the test (e.g., complete blood count, von Willebrand factor levels)
- Tests to define specific platelet or clotting factor abnormalities generally should begin with general screening tests (e.g., platelet count, PT/INR, and aPTT) and then be confirmed with specific tests (e.g., bioassays of specific coagulation factors) by an internist or hematologist.

Specific Coagulopathies

Hemophilias

- The hemophilias are a group of inherited bleeding disorders in which one of the coagulation factors is deficient. The two most common are hemophilia A (Factor VIII deficiency) and B (Factor IX deficiency). Both are X-linked recessive diseases with a wide range of severity that correlates with factor levels.
- Severe disease is defined as less than 1% of normal factor activity, whereas 1% to 5% is moderate, and greater than 5% is mild.

Dental Considerations

- Bleeding may occur anywhere in patients with hemophilia. The most common sites are joints, muscles, and the gastrointestinal tract. With regard to the mouth, the likelihood of bleeding varies with the severity of the disease and the nature of the dental procedure.
- Approximately 25% of patients with severe hemophilia A and 3% to 5% of those with severe hemophilia B develop antibodies (primarily IgG) against the deficient factor. The presence of inhibitors may make the management of bleeding episodes more difficult. In hemophilia B, the development of inhibitors may be associated with some specific manifestations including anaphylaxis and nephrotic syndrome. Inhibitors are much less common in patients with mild or moderate disease.
- The decision regarding the need for blood products replacement for invasive dental procedures should be made with the physician managing the patient's coagulopathy.

- Prevention of oral disease through frequent dental evaluation, fluoride use, strict oral hygiene, and diet control should be stressed to minimize later need for invasive dental procedures.
- Children should be seen starting in infancy to teach parents proper tooth brushing and to ensure adequate exposure to fluoridation.
- Aspirin and other nonsteroidal anti-inflammatory drugs are contraindicated in patients with hemophilia. Pain should be treated with acetaminophen or codeine.
- Moderate and mild hemophilia A can often be managed with the following:
 - Desmopressin: Administered intravenously, by subcutaneous injection, or by intranasal spray. Transiently increases plasma levels of Factor VIII two to four times above the baseline via release from endothelial storage sites, and as much as four to six times above the baseline in those who begin with Factor VIII.
 - Epsilon aminocaproic acid (EACA): Inhibits plasminogen activation in the fibrin clot and improves clot stability.
 - Factors/dihydro-D-arginine vasopressin (DDAVP) and routine local hemostatic measures (e.g., gelfoam and primary closure): These are helpful to maintain the clot.
- Patients with severe hemophilia A will often be given fresh frozen plasma or a Factor VIII concentrate (1 unit/kg of Factor VIII concentrate should raise the plasma level of the patient by 2%).
- In invasive procedures the goal is to raise the factor level to 25% to 50% transiently (the half-life of Factor VIII is about 12 hours). Surgical procedures, including extractions, might require raising the Factor VIII level to 100% with a presurgical bolus injection. This is often followed by 4 to 6 g epsilon aminocaproic acid four times daily for six to eight days, beginning six hours after the procedure.
 - For less invasive procedures requiring infiltration or block anesthesia, the goal is to raise the plasma level to 15% to 20% transiently.

Hemophilia B

Treat either with Factor IX concentrate or with fresh frozen plasma.

von Willebrand Disease

von Willebrand disease (vWD) is an autosomal dominant disorder of platelet function and Factor VIII activity. It is the most common inherited bleeding disorder, affecting up to 1% of the population. It affects platelet plug formation during primary hemostasis and therefore many of its clinical manifestations are similar to those seen in platelet disorders (e.g., prolonged bleeding time, easy bruising).

Inherited von Willebrand disease has been classified into three types:

- Type 1, accounting for approximately 75% of patients, partial quantitative deficiency of von Willebrand factor
- Type 2, characterized by several qualitative abnormalities of von Willebrand factor. There are four subtypes: 2A, 2B, 2M, and 2N

- Type 3, the most severe form, characterized by a total deficiency of von Willebrand factor
- Patients with vWD tend to have a different pattern of bleeding from hemophilia.
- The treatment of vWD include: desmopressin, replacement therapy with von Willebrand factor-containing concentrates, anti-fibrinolytics, and topical therapy with thrombin or fibrin sealant. The majority of patients with mild or moderate Type 1 disease can be managed with desmopressin alone. Replacement therapy with VWF is usually required in Type 3 disease.

Thrombocytopenia

Thrombocytopenia is defined as a platelet count under 150,000/ μ l. It can be congenital, acquired, idiopathic, or secondary to medications or therapy. It is characterized by prolonged bleeding following surgery if platelet counts fall below 50,000/ μ l.

Dental Considerations

- Minimal trauma (e.g., toothbrushing, eating) can cause bleeding with counts below 20,000/ μ l.
- The most common presentation is mucosal or gingival bleeding. Large bullous hemorrhages may appear on the buccal mucosa due to the lack of blood vessel protection by the submucosal tissue. Cutaneous bleeding is manifested as petechiae or superficial ecchymoses.
- Unlike patients with coagulation disorders who experience delayed bleeding (several hours or days after trauma), patients with thrombocytopenia or platelet dysfunction tend to bleed immediately after vascular trauma.

Other Bleeding Disorders

There are many less common bleeding disorders (e.g., Glanzmann thrombasthenia, Wiskott-Aldrich syndrome). The severity of the disease may be determined from the medical history. Additionally, it is important to consult with the patient's physician or hematologist prior to scheduling an invasive procedure.

Medications That Predispose to Bleeding

Aspirin

Aspirin is commonly taken for its anti-inflammatory properties or prevention of coronary ischemic events. Because of its common use, patients might not list aspirin as a medication. There is longstanding dogma that aspirin or other antiplatelet drugs should be discontinued at least five days (the half life for platelets) prior to invasive

dental procedures but there are no data to support this practice (including single tooth extraction). The American Heart Association published a statement warning clinicians about the risk of stopping antiplatelet drugs in patients taking them for coronary stents. Avoid aspirin in patients with pre-existing bleeding disorders.

Nonsteroidal Anti-Inflammatory Drugs

Nonsteroidal anti-inflammatory drugs (NSAIDs) are used for their anti-inflammatory, analgesic, and antipyretic properties. Unlike aspirin, their anti-platelet action is reversible. NSAIDs should be avoided in patients with qualitative and quantitative platelet defects.

Thienopyridines

Thienopyridines (clopidogrel, prasugrel, ticlopidine) are antiplatelet agents used to prevent thrombotic events in patients with a history of myocardial infarction (MI), cerebrovascular accident (CVA), or peripheral vascular disease. Normalization of platelet aggregation occurs five to seven days after discontinuation.

Warfarin

Warfarin is often used for maintenance anticoagulation therapy in patients with atrial fibrillation, atherosclerotic vascular disease, history of blood clot, CVA, prosthetic heart valves, and vascular grafts. Prolongation of PT/INR persists for three to four days after the last dose. INR level recommendations for invasive procedures are controversial; however, current literature indicates that moderately invasive surgery (e.g., single tooth extractions) is safe with an INR up to 4.0. Regional nerve blocks, such as the inferior alveolar nerve, should be done with caution. In general, the risk to the patient from altering the warfarin dosage far exceeds the potential problem of bleeding following a dental procedure.

Heparin

Heparin is generally used as an immediate anticoagulation, short-term treatment or a bridge to long-term anticoagulation with warfarin (e.g., for pulmonary embolus or deep venous thrombosis). It remains active five to six hours after the last IV dose. The use of low-molecular-weight heparin (e.g., Lovenox®) has become increasingly popular because of its more predictable pharmacodynamic effect and once-daily administration compared to unfractionated heparin. The elimination half life is about 4.5 hours after a single subcutaneous dose.

Thrombolytics

Thrombolytics (e.g., streptokinase, tissue plasminogen activator [tPA]), are fibrinolytic agents generally used for immediate thrombolytic treatment of stroke or life-threatening blood clot.

Drug Interactions

Broad-spectrum antibiotics used over an extended period may interfere with the intestinal flora and mucosal absorption. Corticosteroids, some antifungals, and oral hypoglycemics among other medications can interfere with INR levels in patients on warfarin.

Dental Considerations

- Consult with the patient's physician if you are unsure about the impact of the anticoagulant(s) on surgical procedures.
- Infiltration anesthesia is preferred because blocks (e.g., inferior alveolar) could potentially cause bleeding in the pharyngeal space. Consider intraligamental and/or intrapulpal anesthesia for endodontic procedures and infiltration and/or intraligamental anesthesia for extraction procedures.
- Local hemostatic measures: Good surgical technique, pressure, and primary closure should be employed routinely in patients at risk for oral bleeding. The use of topical measures such as gelfoam, thrombin, and topical antifibrinolytics (e.g., epsilon-aminocaproic acid [EACA] rinse) may be used to control mild to moderate spontaneous oral bleeding.
- Exfoliation of primary teeth is generally not a concern because any oozing is usually well controlled by pressure.

Cancer

In cancer patients, the patient's overall medical status and type of cancer therapy are of major concern. Cancer not only can cause significant morbidity, but can potentially lead to oral bacteremia and sepsis. Patients are at risk for developing oral complications throughout the course of cancer therapy and following cancer therapy due to late effects. Problems that arise are generally from two modes of medical therapy: radiation and chemotherapy.

Radiation Therapy to the Head and Neck Region

Although radiation therapy (RT) for most cancers has no discernible effect on the oral cavity or the provision of dental care, RT for the management of head and neck cancer, which may be delivered with concomitant chemotherapy, has a high incidence of oral sequelae.

Significant Elements in the Medical History for Patients Planned for RT

- Date of diagnosis
- Location and histology of the malignancy

- Tumor size, nodal involvement, and metastases (TNM) classification for staging head and neck tumors (Appendix 25, Table 25-2)
- Previous therapy (e.g., RT, chemotherapy, surgery, or a combination, or the use of radio-sensitizers)

Clinical and Radiographic Examination

- Location and size of tumor, if visible
- Status of soft tissues: Careful examination for oral lesions
- Teeth: Number, mobility, bone support, state of repair, caries, periapical or periodontal infection, impactions with or without potential for communication with the oral flora, gingivitis, periodontal disease

Dental Considerations for Patients Undergoing Radiation Therapy

Factors to consider prior to beginning invasive treatment, including restorative procedures:

- Overall tumor staging (TNM) and patient's medical prognosis
- Field (i.e., the area receiving the highest dose), total dose, and fractionation (e.g., twice/day); external beam radiation (e.g., conventional RT, stereotactic RT, intensity-modulated RT) vs. interstitial implant (brachytherapy). Note: 6,000 cGy (centigray) = 60 Gy, where Gy is a unit of radiation called a gray, the standard unit of absorbed ionizing radiation dose, and represents 1 joule/kilogram
- The start date for RT
- Plans for radiation stents to decrease the dose to oral structures
- Plans for cancer chemotherapy prior to, during, or after RT
- Risk/benefit of maintaining each tooth: Often determined by location, degree, and potential for odontogenic infection (i.e., periodontal, pericoronitis, caries)
- Risk for developing oral problems as a result of radiation therapy. For example, mandibular teeth, especially molars, present a greater risk for osteoradionecrosis if extracted immediately before, during, or at any time after RT, and the risk of developing trismus and its impact on the ability to provide dental treatment
- Teeth with overall poor long-term prognosis, as well as those that are non-restorable, should be extracted as far in advance of RT as possible
- Periodontal disease: Teeth with greater than 4-mm pockets should be considered for extraction, especially mandibular posterior teeth if the mandible is in the RT portal
- Dental caries: Generally, if shallow, these can be restored before or soon after RT. If the caries are of moderate depth, ensure pulp vitality and restore before RT, or at least use an intermediate restorative material until more definitive restorations can be accomplished
- Status of salivary gland function following radiotherapy. Parotid gland tissue, if in the radiation field, will usually recover from less than 3,000 cGy but can remain non-functional from greater than 5,000 cGy

- Preventive oral care: It is important to educate patients about their increased risk for dental caries (especially in patients at risk for hyposalivation). A preventive oral health care program (e.g., use of fluoride, noncariogenic diet, more frequent dental visits) should be instituted as early as possible.

Major Oral Complications of Radiation

Mucositis

- Mucositis refers to inflammation of the oral mucosa from RT, which can progress to ulcerations. Mucositis is usually short-term, but in severe cases it can limit the RT dose and interrupt the schedule of radiation. Management includes:
 - Maintaining oral hygiene throughout therapy
 - Bland rinses to debride the mouth, especially in the absence of saliva
 - Altering the oral intake to softer/blander foods at the earliest signs or symptoms to prevent pain or damage to friable mucosa
- Topical anesthetic rinses may be helpful for mild to moderately painful mucositis (Appendix 12, Table A12-4). There are many single and combined preparations
- Topical anesthetics should be used with caution in young children due to their inability to expectorate and their higher risk for overdosage and toxicity
- Systemic analgesics or opioids are necessary for more severe pain. NSAIDs or synthetic opioids should be tried first, with escalation to stronger opioids as necessary. Topical therapies may play an important role as an adjunct to systemic pain control
- When nutrition is significantly compromised, surgical placement of a gastric feeding tube may be required to maintain nutrition and avoid breaks in RT

Xerostomia

Radiation to the head and neck can cause both acute and long-term salivary gland hypofunction, leading to xerostomia; difficulty speaking, eating, and swallowing; and an increased rate of dental caries and candidiasis. Intensity modulated radiation therapy is reported to reduce the incidence and severity of salivary gland damage. Although infrequently used, amifostine, which acts as a free radical scavenger delivered intravenously or subcutaneously, is approved by the Food and Drug Administration (FDA) for the prevention of radiation-induced salivary gland hypofunction.

- Xerostomia can be palliated by the use of oral moisturizing rinses, saliva substitutes, or water (including ice chips).
- Pilocarpine hydrochloride may help to increase salivation and decrease xerostomia in some patients, especially for persistent xerostomia following completion of therapy. The main side effect is excessive sweating.
- Cevimeline, which has been approved for Sjögren's disease, also may be used. As with pilocarpine, the side effects include sweating and gastrointestinal symptoms (Appendix 6, Table A6-5).

Radiation Caries

Radiotherapy damage to the salivary glands and subsequent dry mouth may drop saliva production to less than 5% of normal. Protective immunoglobulin A and the buffering and remineralizing capacity of saliva are lost, with a resultant salivary pH that can drop below 3.5.

- Patients need dietary counseling along with routine and careful follow-up for as long as the mouth continues to have any degree of dryness, with or without an increased incidence of caries.
- Use of extra-strength fluoride toothpaste is very important.
- A neutral sodium fluoride rinse or brush-on fluoride gel should be used every evening after careful tooth brushing and flossing (Appendix 24, Table A24-2).
- Other adjunct therapies include use of casein phosphopeptide–amorphous calcium phosphate agents (e.g., MI Paste™ MI Paste, Recaldent™) and xylitol-sweetened products.
- The diet should be modified to avoid refined carbohydrates, especially sucrose, and acidic foods and beverages (e.g., iced tea).

Infection

Bacterial Gingival organisms might not survive during RT but bacterial and fungal pathogens may increase as a result of RT on the mucosa, decreased oral hygiene, increased cariogenic diet and dry mouth.

Fungal Both pseudomembranous and erythematous candidiasis is common. Fungal infections are often long-lasting and can recur. Management includes topical and/or systemic antifungal agents, and any removable oral appliances must be disinfected nightly (e.g., with dilute bleach solution or Peridex®) (Appendix 12, Table A12-4).

- Clotrimazole troches are given at the onset of infection and continue for the duration of RT. Dissolve clotrimazole troches in water if xerostomia prevents them from dissolving in the mouth. Miconazole is an alternative; some topical preparations may contain high levels of sucrose as a flavoring agent.
- Fluconazole is the usual first line therapy when systemic antifungal medication is required. This medication is dosed once daily and is typically more effective than topical agents and therefore should be considered in cases of refractory infection or in patients in whom compliance with complex daily regimens is a concern.

Osteoradionecrosis

Osteoradionecrosis is characterized by exposed alveolar bone, and is most likely to occur with greater than 60 Gy to the mandible, although the maxilla also can be involved. It is caused by permanent damage to the bone and blood supply, and can occur spontaneously or after an invasive procedure exposing alveolar bone.

Dental Considerations

- Secondary soft tissue infection is common and may require long-term courses of topical and systemic antibiotics.
- Some advanced or longstanding (greater than 6 months) cases may require surgical management, with or without the use of hyperbaric oxygen therapy.
- Invasive dental procedures (e.g., extractions) are best completed prior to RT, with at least one to two weeks for healing.
- Following RT, teeth requiring extraction should be removed as atraumatically as possible, with careful alveoloplasty, primary closure of the mucosa if possible to help maintain the clot, and short-term antibiotic coverage.

Taste Loss/Dysgeusia

Taste loss/dysgeusia is a common problem when the tongue is in the RT field. It usually resolves completely, and the greatest resolution occurs within three months of treatment. Persistent changes at one year are typically permanent.

Trismus

Trismus can arise from radiation, surgery, or a combination of both. It is more common with tumor primary sites in the nasopharyngeal or tonsil region. Soft tissue fibrosis of the tissues surrounding the temporomandibular joint typically develops three to six months after RT and can be progressive.

Dental Considerations

- Oral hygiene practices, speech, nutritional intake, and dental treatment are often challenging for these patients, depending on the degree of trismus. Management requires intensive physical therapy with passive mouth opening exercises or with a device designed for this purpose.
- Some evidence suggests a benefit of exercise that begins during RT.

Tooth and Bone Development RT has an impact on the developing teeth and on active growth areas of the mandible. Direct, high-dose RT to the dentoalveolar complex during early phases of tooth development may destroy odontogenic precursor cells and result in complete agenesis of the tooth. Radiation at a later stage of dental development or at a lower doses results in more minor defects ranging from microdontia, enamel hypoplasia, incomplete calcification to arrested root development.

Chemotherapy

The major concerns with dental management and chemotherapy are related to direct and/or indirect toxicity to the oral mucosa from cytotoxic chemotherapeutic agents. The pathobiology for chemotherapy-related toxicity to the oral mucosa is complex and not fully understood. It involves damage to both DNA and non-DNA targets,

and generation of messenger signals, leading to the production of a variety of biologically active proteins, including proinflammatory cytokines that damage surrounding tissues. The extent and severity of mucositis are influenced by the specific chemotherapy drug (i.e., stomatotoxicity); dose, route, and frequency of administration; and individual patient tolerance (Appendix 12, Table A12-3).

Significance of the Problem

- Mucositis, which affects upwards of 35% of patients, is typically a short-term, self-limiting effect of chemotherapy that can extend from the mouth through the gastrointestinal (GI) tract.
- Other potential consequences include infection of oral mucosa, gingival bleeding, and impaired nutrition.
- Mucositis and infection, along with other mucosal toxicities and bacteremia, in particular alpha hemolytic streptococcal from ulcerative mucosa during myelosuppression, are common problems. Thinned mucosa and ulceration also allow for fungi and viruses to invade local tissues and the circulation.
- Symptoms include painful mucosal inflammation that can extend to limited or extensive ulcerations, severe pain, dysphagia, and an inability to tolerate any oral intake.

Significant Elements in the History

When assessing a patient receiving cancer chemotherapy, consider:

- Tissue diagnosis, prognosis, and chemotherapy regimen
- Overall status, including nutrition, current blood counts, debilitation, ability to tolerate dental treatment

Dental Considerations

- **Timing and type of chemotherapy:** In general, if within the previous three weeks, the oral mucosa and bone marrow may be compromised; the extent is largely dependent on the chemotherapy regimen. Chemotherapy regimens for bone marrow malignancies and conditioning regimens prior to hematopoietic stem cell transplantation are generally more myeloablative compared to those for solid organ neoplasms (e.g., head and neck squamous cell carcinoma) and patients in the former group are at high risk for infectious complications during the period of pancytopenia which typically begins seven to fourteen days after chemotherapy is delivered.
- Cancer patients benefit from a comprehensive oral examination before the initiation of cancer therapies, especially if they are to receive radiation treatments to the maxillofacial region or intensive chemotherapy protocols. Comprehensive preventive oral care appears to diminish the incidence of all oral complications of chemotherapy, but data are lacking.
- Pre-chemotherapy oral hygiene protocols may include root planing and scaling, moderate to deep caries treatment, extractions, and in rare situations, endodontic therapy.

- Gingivitis and periodontal disease involve bacterial plaque adjacent to assumed ulceration in the periodontal pocket and this should be considered a focus of infection in febrile neutropenic patients.
- Blood counts. Exercise caution if the patient has:
 - A total white blood cell count less than 2,000/mcL, and more importantly, absolute neutrophil count (ANC) less than 500/mcL. The duration of neutropenia is the greatest risk factor for infection.
 - Platelets less than 50,000/mcL. If contemplating surgery prolonged mucosal/gingival bleeding is unlikely with a platelet count greater than 25,000/mcL.
- Pre-chemotherapy oral disease such as gingivitis, periodontitis, and periapical disease are thought to increase the risk for mucositis, local infection, and bacteremia from oral pathogens.
- Younger patients may have a greater risk of chemotherapy-induced stomatitis, perhaps related to a higher epithelial mitotic rate and the nature of malignancies being treated (e.g., leukemias).
- Nutritional status, type of malignancy, duration of neutropenia, and the quality of oral care are also thought to influence the severity of mucositis.
- Surgical procedures:

Pretherapy tooth extractions do not pose significant risk of postextraction complications, but they should be done as far from a period of significant neutropenia as possible because re-epithelialization and general healing of the socket and alveolar bone slows or stops during chemotherapy.

 - Attempt to get primary closure of the wound. The use of hemostatic packing agents is controversial.
 - Consider platelet transfusion one-half hour pre-procedure if the platelet count is under 30,000 to 40,000/mcL.
 - Consider antibiotic prophylaxis (e.g., clindamycin 600mg) for tooth extractions that must be done during severe neutropenia (ANC less than 500/mcL).
- Risk of complications from dental treatment: The indication for dental treatment depends on the urgency. Sequelae from postponed treatment also must be considered. For uncomplicated post-surgical healing to occur platelet counts should be maintained above 20,000/mcL for anticipated clot turnover for the following week. The ANC should ideally be maintained at greater than 1,000/mcL for seven to 10 days. Patients might have a coagulopathy from their disease (e.g., leukemia with poor platelet function) as well as from treatment (myelosuppression following chemotherapy).

Prevention of Oral Complications

Preventing and minimizing oral complications during chemotherapy is the goal. Prior to chemotherapy, if the systemic condition allows and there is sufficient time before severe myelosuppressive effects occur, the following measures should be taken:

- Thorough oral examination, including a full-mouth series of radiographs
- Extract hopeless periodontally or cariously involved teeth

- Thorough oral prophylaxis and oral hygiene instruction. Patients should be educated about the relationship between odontogenic disease and problems during chemotherapy
- Orthodontic appliances are almost always removed when intensive chemotherapy is planned, given the potential for gingival inflammation, problems with oral hygiene, and risk of soft tissue injury
- Removable prostheses and appliances generally should be left out of the mouth during periods of neutropenia or thrombocytopenia
- Fluoride: Neutral rinse if the patient can tolerate it or fluoride gel is recommended by some oral care protocols, especially with xerostomia and the desire to arrest carious lesions. Discontinue if mucosal burning sensation occurs. Dose and timing is important with regard to other oral care, such as mouth care, topical anesthetics, and antifungals, so as not to interfere with the benefit of each. For example, mouth care should be done first. Topical anesthetics and antifungals should not be followed by other oral medication or rinses until sufficient time for their efficacy has abated
- Standard oral hygiene (brushing and flossing) should be maintained throughout chemotherapy unless there is gingival bleeding. It is generally felt that the risk of worsening gingival disease (and the resultant increase in potential for bacteremia) is greater than the risk of bacteremia from oral hygiene procedures. In such cases, patients can rinse with sterile saline or bicarbonate or even plain water to debride the mouth and reduce plaque and debris accumulations. Commercial mouthwashes often contain alcohol and can sting ulcerated mucosa, and should therefore be avoided
- Chlorhexidine mouth rinses may be considered in patients with periodontal disease
- Xerostomia is less common with chemotherapy compared to radiotherapy. It can result from anticholinergic medications given for nausea or diarrhea. Some patients note excessive saliva and some experience thick, ropy saliva. Patients also may complain of dysgeusia. Xerostomia in this setting is almost always reversible after chemotherapy and has no significant long-term effects. Therapy is symptomatic (e.g., frequent rinsing with bland, non-cariogenic solutions)

Infection

- During neutropenia, signs and symptoms of infection (e.g., reduces swelling, pain, pus formation) may be muted.
- During severe neutropenia (ANC below 500/mcL), manage with broad-spectrum parenteral antibiotics. Consider covering Gram-negatives and anaerobes (e.g., *Bacteroides* sp., *Escherichia coli*, *Serratia*, *Pseudomonas*, and *Klebsiella* spp.) in addition to the usual Gram-positive oral flora. Elective dental procedures should wait until the ANC rises to more than 1,000/ mcL and platelets to greater than 50,000/mcL.
- For superficial candidiasis provide topical treatment with clotrimazole troches (Appendix 12, Table A12-4). If extensive, or if WBC counts are low, oral or parenteral fluconazole or parenteral amphotericin B may be needed. Some recommend prophylactic oral fluconazole to decrease the incidence of candidiasis but the efficacy is unclear.
- For viral pathogens, the most common is reactivation of herpes simplex virus (HSV) type 1 infection, which tends to be more severe and of longer dura-

tion than non-HSV-associated mucositis. The typical vesicular lesions may not be evident in the presence of chemotherapy-induced mucositis. Infection with HSV should be considered in the differential diagnosis of patients who present with mucosal vesicles or unusually painful oral ulcerations after chemotherapy.

Mucositis Pain

- Begin with frequent rinses with a bland solution (e.g., baking soda and water) and progress to one of several topical anesthetics (Appendix 12, Table A12-4) with or without lidocaine in equal parts. Morphine mouth rinses may have better efficacy than the standard agents such as lidocaine. Various combinations of an anti-inflammatory, a topical analgesic and/or coating agent (e.g., Kaopectate®) are used. Change to systemic opioids if ineffective. The use of patient-controlled analgesia (PCA) has been found to be beneficial in pain alleviation in adult and pediatric hematopoietic stem cell transplant recipients.

Bleeding Gingival bleeding is not uncommon with low platelet counts, especially when prolonged and in the presence of periodontal diseases and associated gingival ulceration. This is usually prevented with good oral hygiene. If brushing and flossing create pain or bleeding, chlorhexidine oral rinses will help to control plaque formation.

- Bleeding usually occurs from the gingival crevice with a very low platelet count (less than 15,000 to 20,000/mcL). If pressure from a wet 2-cm × 2-cm sponge fails to stop the bleeding, a topical thrombin-soaked sponge may be applied to the area and held in place for one to two minutes. Remove the sponge gently so as not to disturb the new clot. There is a degree of concern over the use of topical thrombin because of sensitivity and this should be discussed with the patient's physician. Avoid any gingival manipulation (e.g., brushing) within 48 to 72 hours of oral bleeding or until the platelet count shows a steady increase.

Nutrition Weight loss can be a temporary side effect of a sore or dry mouth or throat, nausea/vomiting, poor appetite, diarrhea, or dehydration. Consult with a dietitian. A soft and/or liquid diet (e.g., ice cream and watermelon) may be helpful. Avoid tart or acidic foods (e.g., citrus juices and fruits, seasoning and spices), alcohol, cigarettes, and very hot or cold foods. Sugarless candy or mints can stimulate saliva production, although sharp edges may injure the oral mucosa.

Tooth and Bone Development Chemotherapy targets rapidly dividing cells throughout the body; therefore, cells that are in non-proliferative germinal stage (e.g., second and third molars in an infant) develop normally and remain unaffected by chemotherapy. Most dental defects from chemotherapy are localized and complete tooth agenesis is rare.

Osteonecrosis from Intravenous Bisphosphonate Therapy Bisphosphonates are given to inhibit osteoclastic activity (Appendix 12, Table A12-2). The intravenous route is used in clinical practice for the management of cancer-related conditions

such as bone metastases from breast, prostate, and lung cancer and management of lytic lesions due to multiple myeloma. Since it was first reported, the term bisphosphonate-related osteonecrosis of the jaw (BRONJ) has been adopted for this condition. It is defined as exposed bone in the maxillofacial region that has persisted for more than eight weeks, in the absence of radiation therapy to the jaws (Appendix 25, Table A25-1). Risk factors for the development of BRONJ are:

- Intravenous route of administration; longer duration is associated with increased risk
- Local factors including dento-alveolar procedures, anatomy, and presence of oral disease

Dental Considerations for Cancer Patients Undergoing Intravenous Bisphosphonate Therapy

The dental evaluation for patients exposed to intravenous (IV) bisphosphonates is similar to patients undergoing radiation therapy. Factors to consider include the following:

- Cancer diagnosis and patient's overall prognosis
- Type, duration, and route of administration of bisphosphonate therapy
- Risk/benefit of maintaining each tooth: Location, degree, and potential for odontogenic infection (i.e., periodontal, pericoronitis, caries)
- It is unclear at this time if patients are more at risk from a dental extraction than from leaving in place a broken down but not obviously infected tooth
- Exercise caution with all dental procedures to keep trauma to soft tissues at a minimum, and avoid exposing bone whenever possible

Cardiovascular Disorders

Significance of the Problem

There are a large number and nature of cardiac conditions of concern to dentists. Some require no change in dental management and others may put patients at considerable risk for dental procedures. In general, if unsure about the patient's cardiac condition, consult the patient's primary care physician or cardiologist for details before dental treatment. Decisions on management rest with the treating dentist, who takes ultimate responsibility for issues such as antibiotic prophylaxis (Appendix 23, Table A23-1).

Considerations Concerning Bacteremia

The oral cavity, and the gingival crevice/periodontal pocket in particular, have a large and varied potential population of bacterial species, and bacteremia from this site is common. However, there are little scientific data to suggest that invasive dental procedures are a significant cause of distant site infection (e.g.,

infective endocarditis), given that far more frequent bacteremia occurs from naturally occurring sources such as tooth brushing and chewing food. Consider that:

- Any manipulation of the gingiva can cause a bacteremia, and a single dental extraction may have a bacteremia incidence of over 90%.
- Routine cleaning (scaling) of teeth is as likely as, or more “invasive,” than an extraction with respect to causing bacteremia.
- The incidence (and perhaps magnitude) of bacteremia likely increases with the number of teeth extracted. The usual duration of a bacteremia ranges between 10 minutes to more than an hour. The duration is likely dependent on host immunity and other factors and the volume of organisms entering the circulation. Pre-surgical antibacterial mouth rinses may have little if any effect on the incidence of bacteremia.
- Systemic antibiotics alter the nature and reduce the incidence and duration of a bacteremia, but it is not clear to what extent they reduce the risk of distant site infections (e.g., infective endocarditis).

Infective Endocarditis

Infective endocarditis is an infection of the myocardium (usually a valve) of the heart by circulating pathogenic organisms.

Congenital Heart Disease

Congenital cardiovascular malformations can be cyanotic (dominant right-to-left shunting), non-cyanotic (dominant left-to-right shunting) or without shunting. Cyanotic defects include tetralogy of Fallot, transposition of the great vessels, anomalies of the tricuspid valve, pulmonary atresia, pulmonary stenosis, Eisenmenger’s syndrome, and hypoplastic left heart syndrome (aortic atresia). Surgical correction of these defects is often accomplished in infancy and early childhood. Non-cyanotic defects include ventricular septal defect (VSD), atrial septal defect (ASD), patent ductus arteriosus, coarctation of the aorta, aortic valve stenosis, and mitral valve prolapse.

Cardiac/Vascular Prostheses

Prosthetic heart valves are either mechanical (man-made materials, usually carbon alloys) or biological/porcine. Mechanical valves are placed in about 60% of patients and they typically require life-long anticoagulation therapy, most commonly with warfarin.

Dental Considerations

- Congenital cardiac defects are associated with many syndromes (including Down syndrome), inborn errors of metabolism, and connective tissue disorders

(e.g., Marfan syndrome, osteogenesis imperfecta, lupus erythematosus). A careful cardiac history should be taken for these patients.

- 2007 American Heart Association (AHA) guidelines recommend antibiotic prophylaxis in the following four groups of cardiac patients given their higher risk of IE with bad outcome (Appendix 21, Table A21-1):
 - History of IE
 - History of heart transplant with an associated new valvular lesion
 - History of unrepaired congenital cyanotic heart disease
 - Prosthetic valve
- Rheumatic heart disease and other conditions such as mitral valve prolapse (MVP) put people at risk for infective endocarditis but the data to suggest these people benefit from antibiotic prophylaxis prior to dental procedures is lacking. AHA guidelines do not recommend antibiotic prophylaxis for any dental procedures for this “moderate risk” group of patients.
- Appropriate laboratory tests for patients taking warfarin is an INR. Rarely, the warfarin dose might need to be adjusted to bring the INR within a safe range for dental procedures, usually less than 4.0. The risks of decreasing the INR (e.g., stroke, thrombosis) greatly outweigh any risk of prolonged bleeding from extractions and other invasive procedures.

Cardiac Pacemaker and Nonvalvular Cardiovascular Devices

Implanted devices, such as cardiac pacemakers and implantable cardioverter-defibrillators (ICDs), are increasingly important in the management of heart failure and the prevention of sudden death from arrhythmias.

Dental Considerations

- The risk of ICD infection from a dental procedure is very low or nonexistent. The AHA does not recommend antibiotic prophylaxis for patients with nonvalvular cardiovascular devices undergoing dental procedures because of lack of evidence to suggest increased risk of device infection.
- Use of certain electronic dental devices, including ultrasonic scalers, electric pulp testers and electrosurgery units, and battery-operated composite curing lights, should be avoided because of possible interference with pacemaker function, at least *in vitro*.

Myocardial Infarction

Significance of the Problem

- Patients with myocardial infarction (MI) may have low cardiac output and/or arrhythmia (e.g., atrial fibrillation).

The major concern is prevention of additional infarction and heart muscle damage.

Dental Considerations

- MI within past six months: Clinical dogma and textbooks suggest that elective procedures should be avoided during this period, but this is based on data that more MIs occur during surgery under general anesthesia. Data are not available concerning the risk of outpatient dental treatment.
- MI more than six months ago: For stressful dental procedures, it is advisable to consult the patient's physician concerning coronary vessel and myocardial involvement, previous coronary artery bypass graft (CABG), arrhythmias, medications, the presence of other vascular disease, and whether or not the patient has a pacemaker or defibrillator.
- The patient may be on warfarin or aspirin therapy for anticoagulation. The INR (if on warfarin) should be less than 3.5 to 4.0 for invasive procedures.
- Avoid long and/or stressful procedures; multiple short appointments may be preferable unless the patient has to travel long distances. Be cautious if using epinephrine as a vasoconstrictor in local anesthetic. Consider nitrous oxide.
- Be aware that gingival hyperplasia can occur with calcium channel blockers.
- Although there is likely an association between periodontal disease and atherosclerosis, independent of common risk factors (e.g., smoking), a causal link has not been established.

Coronary Artery Bypass Graft (CABG)

Reestablishment of blood flow to blocked coronary vessels is important, if it can be done within hours of an MI to prevent ischemia and cardiac muscle cell death.

Dental Considerations

- The major concern for dentists is myocardial infarction. Consult the patient's physician, asking the questions outlined in the MI section above.
- Although some clinicians allow the same six-month delay before resuming dental treatment following CABG surgery as for patients with a history of MI, there is no well documented need to wait longer than six weeks.
- There is no evidence of a risk of infection of grafted coronary vessels from dental procedures.

Angina

Angina occurs when myocardial oxygen demand exceeds supply.

Dental Considerations

- The major concern is to reduce the possibility of an anginal attack. Ask the patient:
 - Does angina occur at rest?

- What are the precipitating factors (e.g., exercise, stairs, emotional stress), frequency, duration, timing, severity of attacks, and response to medication?
- Do you have a coronary stent? Patients may be on antithrombotic therapy with antiplatelet and/or anticoagulant drugs.
- Nonsteroidal anti-inflammatory drugs should be avoided.
- Elective treatment is reasonable if the angina is stable and well controlled by one to two nitroglycerin tablets, and if episodes are less frequent than one per week. Avoid elective treatment if these limits are exceeded because the angina is considered unstable. Crescendo (increasing frequency) angina patients are at high risk for MI. Consult the patient's physician before treatment.
- Assess vital signs at each appointment.
- Many patients with angina are on one or more of the following drugs: nitrates, beta blockers, and calcium channel blockers.
- Side effects from beta blockers include bradycardia, conduction disturbances, and fatigue.
- Side effects from calcium channel blockers include bradycardia, worsening heart failure, headache, and dizziness.
- The patient's nitroglycerin tablets or spray should be readily available during the procedure. If attacks are more than one per week, or if the patient is fearful and non-elective care is planned, consider nitroglycerin use at the start of the appointment.
- Consult the patient's physician when considering sedation or with questions concerning anticoagulation, exercise tolerance, or risk from invasive/stressful procedures.
- Do not stop antiplatelet or anticoagulation therapy for dental procedures.
- Respiratory depressants such as opioids, barbiturates, and other sedatives can worsen the cardiovascular status.
- Nitrous oxide/oxygen relative analgesia can be used safely in cardiac patients, but the oxygen content should not drop below 35%.
- Use of local anesthetics with vasoconstrictors is controversial with some cardiac defects. The benefits of vasoconstrictors (e.g., more profound and longer anesthetic effect) probably outweigh the risks in most cases, but restricted outflow tract defects (e.g., aortic stenosis, hypertrophic cardiomyopathy) are an exception. Avoid concentrations of epinephrine greater than 1:100,000 parts epinephrine and restrict the total volume of local anesthetics.
- Consider short appointments.
- For restorative treatment on elderly patients, particularly in teeth with existing restorations, pulpal discomfort is likely to be minimal and anesthetic may not be necessary. This should be discussed with the patient in advance.

Congestive Heart Failure

Congestive heart failure (CHF) is a common and complex clinical syndrome caused by a variety of cardiac diseases that have a common origin in any structural or functional cardiac disorder that impairs the ability of the ventricle to fill with or eject blood. It is important to understand the status and stages of the CHF.

Classification

The New York Heart Association classification assigns patients to one of four functional classes, depending on the degree of effort needed to elicit symptoms (Appendix 6, Table A6-3):

- Class I: Symptoms of HF only at activity levels that would limit normal individuals
- Class II: Symptoms of HF with ordinary exertion
- Class III: Symptoms of HF with less than ordinary exertion
- Class IV: Symptoms of HF at rest

Significant Elements in the History

- Patients often have a history of coronary artery disease (CAD) and variable levels of compensation, and might be on multiple medications and dietary measures to control and balance cardiac function (Appendix 6, Table A6-3).

Dental Considerations

- If well compensated, patients can undergo elective dental treatment. If not, stressful treatment should be deferred until the patient is stable. Signs of poor compensation include:
 - Paroxysmal nocturnal dyspnea (PND): Patient awakens at night short of breath as a result of pulmonary congestion
 - Orthopnea: Patient might have to sleep with two or more pillows to prevent pulmonary fluid congestion. Patients with orthopnea probably have a low tolerance for the supine position in the dental chair. Consider conducting dental treatment with the patient in the upright or semi-upright position as tolerated
 - Shortness of breath (SOB) or dyspnea on exertion (DOE): Ask how many steps or flights of stairs the patient can climb without having to stop and rest
 - Pedal edema: Results from right heart failure. Question the patient about swollen ankles and examine for a depression left after pressing a swollen ankle with a finger (pitting edema).
 - Body weight: Can fluctuate by a pound or more per day. It is used as an indicator of therapeutic measures and reflects changes in body water.
- Because patients can have orthostatic hypotension (as a result of medication), raise them to a sitting position in several stages over several minutes. Ask them to sit with their feet on floor for 2 minutes before standing upright.
- Patients might have urinary urgency during morning appointments in response to a diuretic. Ask if they would like to use the bathroom before the procedure.

Heart Transplantation

The major concerns are life-long immunosuppression and current cardiac status.

Dental Considerations

- The impact of immune suppression on oral infection and risk for distant site infection from the mouth are unclear. Immunosuppression focuses on lymphocytes, and is at a higher level in the first six months following transplant, after which it is reduced to a lower level.
- Bacterial endocarditis is a concern, as valve damage might follow catheterization for heart muscle biopsy (for evidence of rejection). Consider using prophylactic antibiotics for invasive procedures as per AHA guidelines (Appendix 23, Table A23-1).
- Oral complications include xerostomia, oral candidiasis (secondary to steroids use) and cyclosporin-induced gingival hyperplasia.
- Patients may be anticoagulated with warfarin and should be tested for INR and evaluated as per patients following MI.
- Patients might be best managed by having dental treatment after cardiac transplantation, depending on their overall status and the nature of the indicated dental treatment. A severely compromised patient in cardiac failure is likely at greater risk from dental treatment of any kind before transplantation, in spite of the concern for post-transplant immunosuppression.
- Avoid elective treatment with less stable patients and during a rejection episode.

Cerebrovascular Accident

Cerebrovascular accident (CVA; stroke) presents in a variety of ways, including but not limited to headache, nausea and vomiting, numbness, weakness or paralysis of one side of the body or the face, confusion, and aphasia (inability to speak) (Appendix 5). A transient ischemic attack (TIA) might be a warning of an impending CVA and therefore requires urgent assessment.

Dental Considerations

- CVA generally fall into two distinct categories with occasional overlap:
 - Ischemia, which is characterized by diminished and inadequate blood flow to the brain. This is caused by:
 - a. Thrombus: *in situ* clot in a small or large artery caused by atherosclerosis or other intravascular injury
 - b. Embolus: A clot that is formed elsewhere and travels to the small or large arteries of the brain. This is often seen in patients with atrial fibrillation
 - Hemorrhage, which is characterized by bleeding within or surrounding the brain. This is caused by:
 - a. Intracerebral hemorrhage: Most commonly small vessel bleeding directly into the brain parenchyma
 - b. Subarachnoid hemorrhage: Most commonly ruptured aneurysm that bleeds into the CSF

- Both the onset and extent of the symptoms depend on the severity of the event, whether ischemic or hemorrhagic.
- Patients with a history of CVA might be on anticoagulants (e.g., warfarin, aspirin). An INR test, in the case of warfarin, is necessary to evaluate the risk of bleeding from invasive dental procedures.

Arrhythmias

Arrhythmia is defined as any cardiac rhythm that does not originate in the sinus node and follow normal atrioventricular conduction pathways. There is a wide variety of arrhythmias, some of which are of significant concern for dental procedures.

Significant Elements in the History

- What is the nature of the arrhythmia?
- Is the arrhythmia symptomatic? The following require medical attention:
 - Syncope or near syncope
 - Sustained periods of irregular rhythm
- Does the arrhythmia pose a risk to the patient in the dental office setting?
- Is the patient anticoagulated?
- Does the patient have an implanted device such as pacemaker or defibrillator?

Dental Considerations

- Patients with atrial fibrillation as well as some other arrhythmias are often anticoagulated with an increased risk for bleeding from dental procedures.
- Epinephrine in local anesthetics is not recommended and patients should be monitored during dental procedures.
- Consult with the patient's physician.
- See above for considerations in patients with implantable cardiovascular devices.

Hypertension

Significance of the Problem

- Hypertension is a very common medical condition. Upwards of 29% of Americans, about 58 million to 65 million people, are estimated to have the condition.
- Only about 50% have their blood pressure under control.
- Hypertension is also a problem of childhood, but routine blood pressure measurement for children has a low yield for undiagnosed hypertension.

Classification

See Appendix 6, Table A6-4. The definition is based upon the average of two or more properly measured readings at each of two or more visits after an initial screen.

- Normal blood pressure: Systolic under 120 mmHg and diastolic under 80 mmHg
- Prehypertension: Systolic 120 to 139 mmHg or diastolic 80 to 89 mmHg
- Hypertension: Stage 1: Systolic 140 to 159 mmHg or diastolic 90 to 99 mmHg
- Hypertensive urgency: Asymptomatic patients with diastolic greater than 120 mmHg without evidence of end-organ damage
- Hypertensive emergency/malignant hypertension: Severe hypertension with systolic usually greater than 180 mmHg with evidence of end-organ damage (e.g., CNS: retinal hemorrhage, exudates, papilledema, headache, CVA; Cardiac: MI, CHF; Renal: proteinuria)

Dental Considerations

- The major concern is precipitating a hypertensive crisis, stroke, or MI.
- Patients often show poor compliance with blood pressure medications and diet. They need reinforcement concerning the importance of medications in preventing cardiovascular problems.
- Side effects of antihypertensives vary and can include orthostatic hypotension, synergistic activity with narcotics, and potassium depletion. Beta blockers will decrease the response to medications (e.g., epinephrine) used to treat anaphylaxis.
- The use of epinephrine in patients with hypertension is controversial. However, the benefit from prolonged and more profound anesthesia is thought to outweigh the risk of systemic effects (e.g., acute increase in blood pressure or arrhythmia). Do not use concentrations greater than 1:100,000 parts epinephrine. Aspirate the syringe prior to injection and avoid intravascular injection.
- Poorly controlled or uncontrolled patients should not have a stressful dental procedure until their hypertension is under control. Elective treatment also should be avoided if the blood pressure is significantly above the patient's baseline or if it is greater than 180 mmHg systolic or greater than 100 mmHg diastolic.
- Patients in pain may have some lowering of their pressures after local anesthesia.
- Monitor the blood pressure before, during, and after treatment.

Diabetes Mellitus

Significance of the Problem

- The estimated prevalence of diabetes among adults in the United States ranges from 4.4% to 17.9%.
- Microvascular and macrovascular disease result in complications such as myocardial infarction, stroke, end-stage renal disease, retinopathy, and foot ulcers.
- Good glycemic control decreases the risk of progression of complications of micro- and macrovascular disease.

- Diabetics are at increased risk of atherosclerosis and coronary artery disease (CAD) compared to non-diabetics. In addition, they are more likely to have atypical symptoms of angina and myocardial infarction (MI).
- Prevention of cardiovascular morbidity is a major priority; this is achieved through aggressive medical management of blood glucose as well as other risk factors such as hypertension and hypercholesterolemia.
- Blood pressure and cholesterol level goals are lower in diabetics than in nondiabetics.
- Hypoglycemia is a life-threatening risk of aggressive blood glucose control and should be carefully monitored.

Classification

- Type 1 (formerly insulin-dependent or juvenile onset): Patients produce little or no insulin. This type accounts for about 10% of all diabetics. There is a greater tendency to ketoacidosis than with Type 2. Most children with diabetes have Type 1 and have a lifelong dependency on exogenous insulin. Causes: autoimmune, idiopathic
- Type 2 (formerly non-insulin-dependent or adult onset): Non-ketosis-prone diabetes. Insulin receptors display diminished sensitivity to insulin. Causes: genetic predisposition, obesity
 - In type 2 diabetes, disease onset is insidious
- Gestational diabetes: Onset of impaired glucose tolerance during pregnancy, usually returns to normal after childbirth, with increased risk of developing diabetes within five to 10 years

Hyperglycemia

- Can occur as a result of an infection, MI, stroke, weight gain, pregnancy, hyperthyroidism, steroids, fever, dehydration or non-compliance with medical care.
- Signs include flushed face, dry skin, dry mouth, weakness, dehydration, Kussmaul (very deep and rapid) respirations, elevated pulse, decreased blood pressure, and lethargy.
- Patient can show polydipsia, polyphagia, and polyuria (the “polys”); there might also be abdominal pain, nausea, or unconsciousness. Can result in diabetic coma, with the patient in a hyperosmolar state.
- Hyperglycemia can progress to ketoacidosis and coma over several hours or days in patients with Type 1 diabetes mellitus. Early recognition is important. Give basic life support if indicated. Get immediate medical assistance.

Hypoglycemia: Insulin Shock

- Loss of consciousness occurs rapidly if the blood glucose falls to below 50mg/100cc. Common causes of hypoglycemia are omission or delay of meals, excessive exercise prior to meals, overdose of insulin or oral hypoglycemic agents, and stress.

Table 2.1. Screening Tests for Diagnosis of Diabetes Mellitus

Diagnostic test	Normal	Pre-diabetes	Diabetes mellitus
Random plasma glucose concentration			≥ 200 mg/dL (≥11.1 mmol/L) with classic symptoms of hyperglycemia or hyperglycemic crisis
Fasting plasma glucose (FPG)*	<100 mg/dL (<5.6 mmol/L)	100 to 125 mg/dL (5.6 to 6.9 mmol/L)	≥ 126 mg/dL (≥7.0 mmol/L)
2-h Oral glucose tolerance test (75 gram glucose load)		140 to 199 mg/dL (7.8 to 11.0 mmol/L)	≥ 200 mg/dL (≥11.1 mmol/L)
Hemoglobin A1C		5.7% to 6.4% (6% to 6.4% in the International Expert Committee report)	≥ 6.5%

*Fasting is defined as no caloric intake for at least eight hours.

- It usually appears first as decreased cerebral function, mental confusion, headache, dizziness, changes in mood, hunger, nausea, and increased epinephrine activity (sweating, tachycardia, piloerection, increased anxiety) as an endogenous reaction to raise blood glucose.
- The patient may appear intoxicated and might progress rapidly to unconsciousness, convulsions, and coma.

Treatment

- Early recognition
- Give the patient oral or parenteral simple carbohydrates (e.g., orange juice, soda, sugar)
- Get immediate medical assistance
- Provide basic life support

Significant Elements in the History

- Age of onset
- Control of glucose levels
- Compliance with medical management
- Hemoglobin A1C level (Table 2.1)
- Symptoms: Excessive thirst, nocturia, malaise, decreased appetite, nausea/vomiting, hyperpnea
- Treatment: Make a note of the patient's diet, insulin dosage, route, frequency, and timing of injection. The type of insulin should be noted (Table 2.2). Some patients might use an insulin pump to deliver steady doses of insulin
- Hospital admissions: Record admissions for uncontrolled state (e.g., insulin reactions, diabetic coma)
- Other complications of diabetes: Retinopathy, peripheral neuropathy, gastroparesis

Table 2.2. Types and Durations of Insulin Therapy

Type of subcutaneous insulin	Effect begins	Maximum action	Action effect
Short acting	0.25 to .5 hour	2 to 5 hours	2 to 8 hours
Intermediate acting	3 hours	8 to 12 hours	18 to 24 hours
Long acting or peakless basal	3 to 4 hours	No peak	30 to 36 hours
Rapid acting	10 to 20 minutes	30 to 90 minutes	1.5 to 5 hours

Dental Considerations

General

- Be aware that Type 1 diabetics might have significant atherosclerotic deposits at a younger age than non-diabetics and can therefore have asymptomatic, but significant, vascular disease. Diabetes is the major reason for kidney disease under the age of 25 years and the main cause for dialysis at any age.
- There is an association between diabetes and periodontal disease but the issue of causation in the oral/systemic link with diabetes is controversial and under investigation.
- Dry mouth and xerostomia are common signs and symptoms in diabetics.
- Hyperglycemia can lead to impaired granulocyte phagocytosis and chemotaxis. Data are unclear as to the risks for postoperative infection following dental procedures.

In Well-Controlled Diabetes

- Patients should be scheduled for morning appointments and receive their normal insulin dose if they are able to eat after the procedure; otherwise, reduce the insulin dose.
- Ensure that the patient has eaten a normal breakfast, supplemented with orange or other sugar-containing juice.
- Have glucose available during the treatment.
- Resume normal insulin and oral intake immediately after the procedure.
- Periodontal disease is a common complication of diabetes and it can contribute to poor glycemic control and mortality from ischemic heart disease and nephropathy.
- Annual dental examination is recommended in both dentate and non-dentate diabetic patients. In a 2004 U.S. survey, 67% of respondents with diabetes reported a dental visit in the preceding twelve months.

In Poorly Controlled Diabetes

Major concerns in dental management are avoiding hypoglycemia in the dental office and a poor response to dental and periodontal infections.

- Consider consulting the patient's physician for extensive periodontal or oral surgical procedures.
- Avoid stressful procedures.
- Although antibiotic coverage is often recommended it is rarely if ever indicated for invasive dental procedures, and there are no data to support this practice. Although there is *in vivo* evidence to suggest an increased risk of infection (from decreased neutrophil function) this is not evident clinically. However, infection in diabetics is often difficult to control and their medical management can be complicated by even asymptomatic oral infection (e.g., generalized periodontitis).
- Issues of increased risk of oral infection and impaired wound healing are controversial.
- Problems with infection: Admission to the hospital might be indicated for any diabetic with severe oral infection.
- The insulin requirement may be affected by oral infection or generalized periodontal disease: Discussion with the physician about the need to adjust insulin dose may be warranted after resolution of the infection.

Drug Abuse

Prescription and Non-Prescription Drugs

Significance of the Problem

The Fourth Edition of the American Psychiatric Association's Diagnostic and Statistical Manual (DSM IV) gives a list of 11 classes of substances that can cause intoxication, abuse, and dependence:

- Intoxication: Reversible syndrome of maladaptive behavioral or psychological changes, such as mood lability, cognitive impairment, or poor judgment after ingestion of a substance
- Abuse: Pattern of substance use that results in job, interpersonal, or repeated legal difficulties, and/or recurrent substance use in physically hazardous situations
- Dependence: Maladaptive pattern of substance use characterized by repeated ingestion despite physical or psychological problems caused by the substance, ingesting larger amounts of the substance over longer periods, unsuccessful efforts to limit its use, tolerance to its effects, and physiologic withdrawal

Opioids

The prevalence of prescription opioid abuse in the United States has increased in the past decade, and has become one of the fastest growing drug problems in the nation.

Dental Considerations

- History taking for a patient who admits to abusing opioids should focus on the amount of drug used recently, route of administration, last use, previous attempts at drug treatment, and problems that have resulted from drug use. Using a direct approach and asking questions concerning drug abuse as part of the overall history taking makes this easier for both the patient and clinician.
- Keep meticulous records. Prescription numbers should be written out to avoid forgeries (e.g., “Disp: 10 (ten) tabs”).
- Opioids cause central nervous system depression and repeated use causes opioid tolerance.
- The risks of interaction between prescribed and abused drugs should be discussed with the patient.
- There is an increased incidence of hepatitis B and C and HIV in intravenous drug users. Liver function and coagulation tests should be checked for the possibility of decreased drug metabolism, coagulopathy, and possible chronic hepatitis.
- Between 1% and 7% of Caucasians of European descent have a genetic defect placing them at risk of respiratory depression from small doses of codeine. A patient history of adverse reactions to codeine consistent with intoxication should prompt selection of a different drug or markedly lower dose.
- Rampant caries can occur as a result of xerostomia, excess refined carbohydrates in diet, poor oral hygiene, and overall neglect.
- Concurrent psychiatric conditions are common.
- Defer elective care for patients that are under the influence of cocaine. Cocaine can potentiate cardiac arrhythmias in the presence of certain drugs (e.g., epinephrine).

Methamphetamines

Methamphetamines have a variety of stimulant, anorexiant, euphoric, and hallucinogenic effects. Recreational use has reached epidemic proportions in the United States and elsewhere in the world.

Dental Considerations

- Consider the possibility of methamphetamine intoxication and immediate medical referral for any diaphoretic patient with hypertension, tachycardia, severe agitation, and psychosis. Acutely intoxicated patients may become extremely agitated and pose a danger to themselves and others.
- Methamphetamine intoxication ranges from the virtually asymptomatic to those in sympathomimetic crisis with seizures, metabolic acidosis, and imminent cardiovascular collapse. They may be agitated with tachycardia and psychosis.
- Patient examination may identify mucosal injuries from insufflation (snorting), oropharyngeal burns in methamphetamine smokers, and gingival hypertrophy. Extensive caries (“meth-mouth”) and general destruction of the dentition is common in chronic methamphetamine abuse due to bruxism, decreased saliva production, and poor nutrition and dental hygiene.

Alcohol

Alcoholism is defined by the National Council on Alcoholism and Drug Dependence and the American Society of Addiction Medicine as “a primary chronic disease with genetic, psychosocial, and environmental factors influencing its development and manifestations.”

Significance of the Problem

- Approximately ten percent of Americans abuse alcohol.
- It is a highly prevalent and disabling condition, associated with high rates of medical and psychiatric comorbidity and early mortality.
- It is often progressive and fatal. It is characterized by impaired control over drinking, preoccupation with the drug alcohol, use of alcohol despite adverse consequences, and distortion of thinking, most notably denial.
- Alcohol can be a significant contributing factor to hepatitis, hypertension, tuberculosis, pneumonia, pancreatitis, and cardiomyopathy. Half of all cases of cirrhosis in the U.S. are due to alcohol abuse.
- Alcohol abuse contributes to cancers of the mouth, esophagus, pharynx, and larynx, especially in combination with tobacco use.
- It is associated with several psychiatric disorders, notably mood disorders such as depression, eating disorders, and anxiety disorders.

Dental Considerations

- Treatment should be deferred with patients that appear to be under the influence of alcohol because of the risk of injury, decreased gag reflex, and problems of informed consent. Morning appointments may be best.
- Alcoholic liver disease may be associated with laboratory abnormalities including but not limited to:
 - Aspartate aminotransferase (AST or SGOT)
 - Alanine aminotransferases (ALT or SGPT)
 - Gammaglutamyl transferase (GGT)
- The most common pattern of liver biochemical test abnormalities with alcoholic hepatitis is a disproportionate elevation of serum AST compared with ALT, usually greater than a 2:1 ratio.
- Consider laboratory tests to assess bleeding tendencies (PT/INR to detect vitamin-K-dependent Factors II, VII, IX, X) and liver function (e.g., ability to metabolize medications): Hepatitis screen, AST, ALT, bilirubin, albumin; HIV (if indicated) (Appendix 18).
- A history of delirium tremens (occurs 72 hours to 96 hours after the last drink) is important because this can be fatal without appropriate medical management.
- Opioids should be avoided due to concern for respiratory depression when combined with alcohol.
- Educational materials on this topic are available for patients.
 - www.uptodate.com/patients
 - World Health Organization (www.who.int/substance_abuse/publications/en)
 - National Institute on Alcohol Abuse and Alcoholism (www.niaaa.nih.gov)

- A possible relationship between alcohol-containing mouth rinses and oral cancer has been suggested. This relationship has not been firmly established, but for the time being the use of alcohol-containing mouth rinses in high-risk populations should be restricted

Fever of Unknown Origin

Fever of unknown origin (FUO) is defined as a prolonged febrile illness without an established etiology despite intensive evaluation and diagnostic testing. Evaluation for an oral source comes late in the evaluation for a source of FUO because true FUO would be a very rare finding in a non-immunosuppressed patient without any oral signs or symptoms or oral infection.

Classification

Most cases of FUO are from infections (e.g., tuberculosis, abscess), connective tissue diseases (e.g., vasculitis, systemic lupus erythematosus), or malignancies (about 20%). In upwards of 50%, no diagnosis is made.

Dental Considerations

- Because osteomyelitis can be a cause of FUO, examine for exposed mandibular bone (e.g., BRONJ).
- Apical dental abscesses are a rare cause of persistent fever in the absence of local signs or symptoms. Most cases of FUO from a dental source resolve with removal of the involved teeth, with or without antimicrobial therapy.
- Other conditions linked to oral disease include brain abscesses, meningitis, mediastinal abscesses, and endocarditis; these are more common than a dental source.
- FUO in disabled children is rarely the result of dental infection and far more often the result of dehydration or aspiration pneumonia/respiratory infection.
- Dental evaluation should include:
 - A thorough oral exam to include periodontal probing, percussion of teeth, and evaluation of salivary ducts
 - Full mouth radiographs with periapical imaging to help exclude odontogenic infection, caries, and/or periodontitis

Human Immunodeficiency Virus Infection

Human immunodeficiency virus (HIV) is the retrovirus that causes acquired immunodeficiency syndrome (AIDS) by infecting dendritic cells, macrophages, and CD4+ lymphocytes. Its routes of transmission include sexual contact with infected partners, exposure to contaminated blood through shared needles or accidental needle stick, and perinatal transmission (in utero, peripartum, breastfeeding). The time from infection to the development of AIDS, which is defined as an opportunistic

infection or malignancy or CD4 count less than 200/mm³, can be greater than ten years in untreated patients. In children, 15% have rapidly progressive disease while the remainder either have a chronic progressive disease or have a disease pattern typical of that observed in adults.

Advanced AIDS is characterized by severe cell-mediated immunodeficiency with consequent opportunistic infections, malignancies, encephalopathy, and wasting.

- Viral infections: herpes simplex, varicella, Epstein–Barr, cytomegalovirus
- Viral and parasitic diarrheal illnesses
- Fungal infections: Skin, oral and systemic candida, and other less common species
- Protozoal infections: *Pneumocystis carinii*, toxoplasmosis, and cryptococcus
- Mycobacterium infections including tuberculosis and less common species (*Mycobacterium avium*)
- Kaposi's sarcoma and lymphoid malignancies

Treatment

Since the introduction of protease inhibitors in the mid 1990s, optimum therapy has consisted of multiple antiretroviral agents, commonly referred to as highly effective antiretroviral therapy (HAART). The goal for HAART is to achieve and maintain an undetectable (less than 50 copies/cc) viral load.

Dental Considerations

- Aggressive management of HIV-associated periodontal diseases involves debridement with antiseptic rinses; consider metronidazole or amoxicillin therapy for five to seven days after debridement (Appendix 12, Table 12-4)
- Antibiotic coverage: Although not evidence-based, consider brief antibiotic coverage for invasive procedures if neutrophil counts are below 500 cells/microliter. There is an increased risk of fungal overgrowth with prolonged antibiotics. The literature suggests a low incidence of complication following invasive procedures such as extractions
- Disease progression: The CD4 is a fair marker of the patient's overall condition but neutrophil counts are a better indicator for the risk from invasive procedures. HIV viral load is quantified as the number of HIV RNA copies/cc plasma using reverse transcriptase polymerase chain reaction (RT-PCR) technology
- Oral manifestations: A CD4 count below 500 cells/microliter increases concern for secondary problems but oral manifestations do not usually occur above 300. The onset of oral lesions often signifies advancing disease and lower CD4 counts (e.g., hairy leukoplakia, oral candida, Kaposi's sarcoma, lymphoma). Salivary gland enlargement, non-healing ulcerations, acute necrotizing periodontitis, and herpes simplex infection can occur
- Three drugs (famciclovir, acyclovir, and valacyclovir) have been shown to be effective in randomized, double-blind trials for treatment or suppression of mucocutaneous herpes simplex virus (HSV) lesions in HIV patients

- Oropharyngeal candidiasis is very common with CD4 counts below 200, and may require aggressive and lengthy treatment. Recurrence of infection is common. Consider nystatin suspension or clotrimazole (Mycelex troche) if the CD4 count is high and infection is not widespread throughout the mouth and esophagus (Appendix 12, Table A12-4). In mild cases, clotrimazole and fluconazole are considered equally efficacious and superior to nystatin. In more complicated cases or with risk of esophageal involvement, oral therapy with fluconazole is superior to topical treatment. Consult the patient's physician if the infection is refractory to oral antifungal agents
- A Cochrane systematic review suggests that:
 - In the treatment of candidiasis, fluconazole, compared to nystatin, favored clinical cure in adults. There was no difference with regard to clinical cure between fluconazole and ketoconazole. When compared with clotrimazole, both fluconazole and itraconazole proved to be better for mycological cure. Both gentian violet and ketoconazole were superior to nystatin in bringing about clinical cure
 - In the prevention of candidiasis, success was defined as the prevention of a relapse while receiving prophylaxis. Prevention of clinical episodes was favored by fluconazole over placebo. Comparing continuous fluconazole treatment with intermittent treatment, there was no significant difference. Chlorhexidine was compared with normal saline in a single study with no significant difference between the treatment arms
- HIV-infected children may have psychosocial, socio-economic, and environmental factors that add to their risk of caries and require regular, thorough oral evaluation
- Prevention of recurrence is no longer favored because there has been a decline in both chronic and recurrent disease in the HAART era. Long-term suppressive therapy with fluconazole is effective but no longer recommended due to low morbidity associated with infection and potential drug-interaction and resistance

Intellectual Disability

Intellectual disability includes a wide variety of conditions including genetic syndromes (e.g., Down, fragile X, and others), traumatic brain injuries, pervasive developmental disorders (autism and schizophrenia), attention deficit hyperactivity disorder (ADHD), and microcephaly. In addition, physical impairments such as cerebral palsy and spina bifida can have an accompanying defect in intellectual functioning.

Down Syndrome (Trisomy 21)

Down syndrome is the most commonly occurring syndrome, with intellectual impairment as one of the characterizing features. It is a chromosomal disorder in which there are 47 chromosomes, with three in place of the usual two at chromosome 21. Down syndrome is characterized by:

- Altered craniofacies to include flat facial profile, open mouth posture, and protruding and furrowed tongue
- Congenital cardiac anomalies: Atrioventricular septal defect with or without other lesions (45%), ventricular septal defect with or without other lesions (35%), isolated secundum atrial septal defect (8%), isolated persistent patent ductus arteriosus (7%), and isolated tetralogy of Fallot (4%)
- Risk of cardiac disease is increased in up to 71% of older Down syndrome patients, with mitral valve prolapse in 52%, tricuspid valve prolapse in 14%, and aortic regurgitation in 12%
- Impaired immune system: Increased susceptibility to infection, autoimmune disorders, and malignancies. Chemotactic defects, decreased IgG levels, and quantitative and qualitative abnormalities of the T cell and B cell systems have been inconsistently demonstrated
- Increased risk of celiac disease (3.6%) and acute lymphoid and non-lymphoid leukemia (1.5%), as well as gastric and testicular cancer in males. Increased risk of diabetes mellitus and thyroid disease

Dental Considerations

- Fifty percent have congenital heart disease (CHD), and along with gastrointestinal and other malformations and infections, account for a significantly increased rate of hospital admissions. Consult AHA antibiotic prophylaxis guidelines for indications and dosing of antibiotics for invasive dental procedures (Appendix 23, Table A23-1)
- Increased risk for periodontal disease, potentially because of impaired immune system and diabetes mellitus. Therefore, more frequent periodontal maintenance is often needed
- As a result of congenital laxity of the transverse ligament between the atlas and odontoid processes of the vertebrae and the atlas and occipital condyles at the base of skull, patients are vulnerable to subluxation of the cervical spine during general anesthesia. Fit a neck collar as a precaution or exercise care when handling the head or neck region
- Most children with Down syndrome are functionally independent, apart from the need for support and supervision for communication and tasks relating to social skills and complex items of self care. Adults are also at higher than normal risk of dementia, at widely varying ages, because of factors influencing beta-amyloid
- Obesity is an issue in older patients and might preclude the use of general anesthesia
- The prevalence of hepatitis B, especially in individuals living in residential care, is higher than in the normal population

Oral and Dental Features

- Relative midface hypoplasia
- Observe for angular cheilitis, lip fissuring, and candidal infection

- Intraorally, the vault of the palate may be high. A relative class III malocclusion might be present
- Retention of primary teeth is common, with delay in shedding sometimes lasting beyond the third decade, and delay in eruption or agenesis of successor teeth
- Periodontal disease is common, resulting in tooth mobility and early loss due to impaired immune status (impaired phagocytic function of monocytes and neutrophils, enhanced PGE2 production, increased activity of plasminogen activators, and thus collagenase activity) and compromised oral hygiene
- The teeth might be diminutive, hypoplastic, and worn due to grinding and reflux/acidogenic diet

Fragile X Syndrome

In patients with Fragile X syndrome, observe similar precautions as for Down syndrome with respect to risk of CHD. Affected males and heterozygous females can show signs of autistic behavior.

Autistic Spectrum Disorders (ASD)

Autism is a group of biologically based neurodevelopmental disorders characterized by impairments in three major domains: socialization, communication, and behavior. Autism is one of a group of neurodevelopmental disorders known as pervasive developmental disorders (PDD). ASD currently encompasses autistic disorder, Asperger syndrome, and PDD-not otherwise specified.

Classification

- Autistic disorder is the most severe form of ASD; many are nonverbal, have significant cognitive impairments, and have severe motor stereotypies and disruptive behaviors. Diagnosis can often be reliably made by the age of three years. Clear causes of autism remain uncertain; however, some environmental factors, such as prenatal infections with rubella and cytomegalovirus, untreated metabolic disorders (e.g., phenylketonuria), and tuberous sclerosis may account for some cases of autism.
- Conditions associated with autism include intellectual impairment (70% to 90% of cases), epilepsy (25% to 30%), fragile X syndrome (2% to 8%), and tuberous sclerosis (1% to 3%).
- The diagnosis of Asperger disorder is made when autistic symptoms are present with no significant delay in language and cognitive development. Often the label “high-functioning autism” is used interchangeably with Asperger disorder. However, there is controversy as to whether children with Asperger disorder, who have normal language milestones, should be considered as a subgroup distinct from high-functioning children with autism, who have a history of delayed language development.

- A diagnosis of PDD-not otherwise specified is a diagnosis of exclusion and is made when the triad of symptoms is present but the criteria are not met for a specific PDD

Treatment

Management focuses on intensive behavioral therapy, instituted early in a child's life, which can be beneficial although not curative. Psychoactive drugs and/or anti-convulsants are frequently prescribed in patients with ASD. Risperidone and aripiprazole are approved for irritability associated with ASD. Other medications including selective serotonin reuptake inhibitors and dopamine blockers are often prescribed off-label.

Dental Considerations

Behavioral problems are common and there is a need for patience and consistency. Elective approaches involve behavior modification and sedation.

Attention Deficit Hyperactivity Disorder

Attention deficit hyperactivity disorder (ADHD) is a developmental condition of unknown etiology characterized by inattention and distractibility, with or without hyperactivity that requires an onset of symptoms before the age of seven years. These symptoms may persist through adolescence and adulthood or they may ameliorate and disappear. There are three types of ADHD: Predominantly hyperactive, predominately inattentive, and combined.

Features

- The prevalence in school-aged children in the U.S. is 3% to 7%. In children, it is three to five times more common in males than females.
- The prevalence in the adult general population in the U.S. is 4% to 5%. In adults, the male:female ratio is closer to even.

Treatment

Behavior modification, educational, and pharmacological measures:

- Psychostimulants (methylphenidate hydrochloride if the child is over six years of age)
- Dexamphetamine: Side effects include anorexia, sleep problems, irritability, abdominal pain, and headaches

- Clonidine (an antihypertensive)
- Antidepressants (e.g., selective serotonin reuptake inhibitors [SSRIs], tricyclic antidepressants [TCAs], monoamine oxidase inhibitor [MAOIs])
- Neuroleptics

Dental Considerations

Refer to dental considerations under the section on ASD.

Liver and Spleen

Hepatitis

Classification

Hepatitis A

Hepatitis A, also known as infectious hepatitis, is spread via the fecal–oral route, contaminated water, and food. The most common risk factor in the U.S. is international travel. The incubation time is two to six weeks. Acute infection is characterized by fatigue, malaise, fever, nausea, vomiting, and right upper quadrant pain followed by jaundice. Although the disease is usually self-limited it can rarely cause fulminant hepatic failure and death in some patients with underlying liver disease. Vaccination is available for pre-exposure prophylaxis in travelers.

Hepatitis B

Hepatitis B is also known as serum hepatitis. It is transmitted through contact with infected blood (needles, razors, toothbrushes), nasopharyngeal washings, semen, menstrual fluid, vaginal secretions, as well as perinatal transmission. The incubation period is two to six months. Five percent of adults infected develop chronic active hepatitis, the sequelae of which range from asymptomatic carrier state to cirrhosis, end stage liver disease, and death. Factors that increase the risk of exposure include drug abuse, long-term residential or institutional care, transfusions of blood and blood products, newborns of women with hepatitis B, and recent immigrants from southeast Asia.

Hepatitis C

Hepatitis C also is known as transfusion-associated hepatitis. It accounts for the majority of non-A and non-B hepatitis. Transmission is through contact with infected blood through sexual contact, shared injection drug equipment, blood transfusion, and other exposures. The incubation period is from six weeks to six months. Although most acute cases are asymptomatic, some patients develop symptoms of acute hepatitis A with malaise, anorexia, nausea, or right upper quadrant pain for

two to eight weeks. Fulminant hepatic failure is very rare. Sixty to eighty percent of acute cases progress to chronic disease with 20% to 30% percent of those developing cirrhosis.

Hepatitis D

In hepatitis D (delta virus), the epidemiology, transmission, and concerns for dental practice are the same as for hepatitis B virus (HBV) and hepatitis C virus (HCV).

Features

- Gastrointestinal: Nausea, vomiting, severe anorexia, and a flu-like fever
- Jaundice: Can occur within a few days of the prodromal symptoms
- Extrahepatic: Possibly as a result of circulating immune complexes:
 - Transient serum-sickness-like symptoms: Urticaria, rash, polyarthralgia, or arthritis. These generally occur one to six weeks prior to the onset of clinical symptoms
 - Polyarteritis nodosa
 - Glomerulonephritis

Diagnosis and Progression

See Appendix 17.

- Hepatitis serology tests, including antigens and antibodies
- Liver function tests: Serum aspartate aminotransferase (AST or SGOT) and alanine aminotransferase (ALT or SGPT)
- Bilirubin
- White blood count (WBC): Often leukopenic; it is possible to have lymphocytosis
- Serum albumin: Decreased
- Serum globulin: Increased
- Lactic dehydrogenase
- Alkaline phosphatase
- Liver biopsy in advanced cases

Prevention

Hepatitis A

- Virus is stable at room temperature for one hour and for years when frozen
- Practice hand-washing after bowel movements and before meals
- 3% sodium hypochlorite, autoclaving at 100°C for 5 minutes, and ultraviolet light for 1 minute at 1.1 W will inactivate hepatitis A virus
- Vaccination is available and recommended in those over the age of 12 months who are at risk of serious illness with infection. Protection can last up to 25

years in adults. Immune globulin is available for short-term (three-month) protection both before and after exposure but must be administered within two weeks of the exposure for maximum effect

- Practice universal precautions

Hepatitis B and C

- Methods of inactivating hepatitis B virus: 0.5% NaOCl with low concentration of protein, 5% of NaOCl with whole sera for three minutes, autoclaving at 100°C for 10 minutes, ethylene oxide, 2% activated glutaraldehyde solutions yielding a pH of 2.4 for six hours
- Health care workers should be vaccinated against hepatitis B. Post-exposure prophylaxis with hepatitis B vaccine given within 24 hours is the standard of care to prevent infection in the setting of known exposure. Immune globulin is sometimes added for increased protection
- Practice universal precautions

Dental Considerations

- All health care workers should be vaccinated against hepatitis B.
- Practice universal precautions with all patients.
- Post-exposure prophylaxis is available for hepatitis B. All exposures should be reported to occupational health authorities.
- Most cases of acute hepatitis resolve spontaneously. Elective treatment should be avoided in patients with acute hepatitis.
- Evaluate liver function prior to prescribing medications metabolized by the liver (e.g., benzodiazepines, acetaminophen).
- Liver-dependent factors involved in hemostasis should be checked prior to surgery; the PT/INR test is the most valuable.

Liver Failure and Transplantation

Liver failure refers to the development of severe liver injury with impaired synthetic function and encephalopathy. Acute (or fulminant) liver failure, most commonly viral or toxin-mediated, is characterized by the development of encephalopathy within eight weeks of onset of symptoms in a previously healthy person or within two weeks of onset of jaundice in a patient with or without previously recognized liver disease. Subacute (or subfulminant) liver failure develops more slowly, with onset of encephalopathy usually occurring after six months. The clinical syndromes differ in their clinical presentation, natural history, and prognosis.

Dental Considerations

- Acute liver failure can result from a wide variety of causes, including but not limited to viruses, toxins (acetaminophen, amanita phalloides), ischemia or shock liver, clot, or autoimmune hepatitis.

- Elective procedures should not be performed on patients with advanced liver disease.
- Pre-transplant patients likely have:
 - Poor drug metabolism: Use caution with drugs metabolized in the liver
 - Bleeding disorders from decreased liver-dependent factors
 - Hypoglycemia
- Post-transplant patients:
 - Immunosuppression leads to increased risk of infection
 - Elective dental procedures that may induce bacteremia should be avoided, particularly in the six months following transplantation when immunosuppressive agents are given in high doses
 - Potential for adrenal suppression secondary to the use of prednisone

Glycogen Storage Diseases

Glycogen storage diseases are inherited disorders affecting the enzymes involved in glycogen metabolism and storage. Glycogen is the stored form of glucose and is used when the body requires glucose either due to high demand or low availability (oral or parenteral). These disorders primarily involve the liver and skeletal muscle. Hepatic involvement can lead to hypoglycemia with or without hepatomegaly. In addition to hypoglycemia that resolves with glucose administration, some patients have a bleeding tendency from impaired platelet function and a prolonged bleeding time. Fifteen glycogen storage diseases have been identified.

Dental Considerations

- Severe periodontal disease and oral ulceration (defects in neutrophils and decreased chemotaxis)
- High caries risk due to high/frequent prescription of non-milk extrinsic sugars (NMES) diet (complex carbohydrates and cornstarch dietary supplements)

Asplenia

The loss of splenic function can be due to a congenitally or surgically absent spleen, infiltrative disease, malignancy, sequestration or hematologic disorders, or atrophy secondary to repeated infarcts or blood clots. The spleen is a fundamental part of the immune system, filtering out old, poorly functioning, misshapen, and damaged red blood cells as well as participating in immunologic destruction and processing of intracellular debris and organisms. As the largest lymphoid organ, it houses nearly 50% of the body's B lymphocytes as well as IgM antibodies and opsonins. Although the full function of the spleen has yet to be completely understood, there is a clear understanding that loss of splenic function, particularly of opsonins, leads to an increased susceptibility to certain bacterial infections, especially those caused

by encapsulated organisms. These organisms include *Streptococcus pneumoniae*, *Haemophilus influenzae*, and *Neisseria meningitidis*. *Staphylococcus aureus*, group A streptococcus, malaria, and other bacteria and parasites can also cause severe disease. Vaccination is the cornerstone of prophylaxis and management of asplenic children and adults.

No data exist to implicate dental treatment (and a resultant bacteremia) as a cause of systemic infection in asplenic or hyposplenic patients. However, antibiotic coverage may be justified in splenectomized patients with primary disease such as Cooley's anemia, Wiskott-Aldrich syndrome, histiocytosis, and lipid storage diseases.

Neurologic Disorders

Cerebral Palsy

Cerebral palsy (CP) is a complex assorted group of motor and postural disorders caused by injury to the developing brain during the pre-, peri-, or postnatal period. Currently the syndromes are grouped into three main categories with some overlap: spastic, dyskinetic, and ataxic. They range in their effects depending on the extent of cerebral damage: one limb (monoplegic) or all limbs (quadriplegic). Conditions often associated with CP include epilepsy (15% to 60%), intellectual impairment (30% to 50%), sensory and emotional disorders, speech and communication defects, and dysphagia.

Dental Considerations

- Not all patients with cerebral palsy have accompanying global developmental delay. It is important to communicate with patients at an age-appropriate level.
- Poorly functioning mastication can result in a diet of soft foods with the result that the teeth are not kept as clean, leading to an increase in caries.
- Many patients exhibit failure to thrive and need supplemental feeding and/or placement of a gastrostomy tube, such as a percutaneous endoscopic gastrostomy (PEG). The use of PEG tube increases prevalence of calculus and predisposes to periodontal disease. Calculus is reported to cause an increase in aspiration pneumonia.
- Drug-induced gingival overgrowth can occur.
- There is a high incidence of Class II malocclusion and anterior open bite. The causes include hypotonia of the orofacial musculature resulting in forward tongue posturing, a poor swallow reflex, and frequent mouth breathing.
- There is an increased incidence of traumatic dental injuries due to malocclusion and difficulties with ambulation.
- Enamel hypoplasia can occur.
- There may be deep dental erosion from gastroesophageal reflux disease (GERD) and tooth wear from bruxism.

- Drooling (sialorrhea) may occur due to the inability to swallow saliva because of oromotor dysfunction. Complications include perioral chapping, infection, dehydration, and psychosocial implications (e.g., social isolation). Some of the therapeutic modalities include injections of botulinum toxin A and antisialagogues.
- Oral care may be impaired due to many factors (e.g., dyskinetic movements) and the presence of pathologic oral reflexes (biting and vomiting).
- Due to the risk of aspiration, consider positioning the patient in an upright or semi-upright position during dental treatment. Consider using a rubber dam for restorative treatment.
- The use of nitrous oxide sedation or oral benzodiazepines might reduce muscle hypertonicity.

Dementia

Dementia is a progressive, degenerative neurological syndrome characterized by loss of short- and long-term memory, impaired reasoning, and personality changes (including paranoid delusions and strong aversions to unfamiliar people, locations, and situations). Patients eventually progress to total dependence, inability to communicate, and ultimately coma and death. Dementia affects approximately 5% of those over age 65, and 20% to 45% of those over age 85. Approximately 50% of cases are termed Alzheimer disease, in which degeneration in function is correlated with insoluble protein plaques and tangles in the cerebral cortex. The second most common cause involves multiple small infarcts in the cerebral cortex (vascular or multi-infarct dementia).

Alzheimer Disease

Thirteen percent of people over the age of 65 have Alzheimer disease (AD). The prevalence increases with age. The causes are unknown. There may be a genetic predisposition in a few cases (1%).

Presenting Features

- Loss of short-term memory initially
- Personality changes (frontal lobe involvement)
- Purposeful wandering secondary to memory loss
- Confusion (due to delirium, dementia, depression)
- Deterioration of personal hygiene
- Loss of language skills
- Immobility
- Incontinence
- Generalized wasting of the body

Treatment

- Disease-modifying drug therapy is not available.
- Cholinesterase inhibitors and memantine are available for treatment of memory, confusion, and language deficits with varying degrees of success and side effects.
- Patients may be on alternative therapies despite limited supporting evidence.

Dental Considerations

- Consent for care: Many dementia patients do not have decision-making capacity, but plans for care should be discussed with them despite impaired cognitive function. This encourages a trusting professional relationship and allows the patient to participate as fully as possible in his or her care. The patient might have the capacity to consent for certain elements of the plan of care. In all cases, decisions of care should also be discussed with the guardian or caregiver, with the patient's permission.
- Progressive cognitive decline: Self-care and ability to cooperate in the dental environment will likely continue to deteriorate over a period of one to several years. Dental treatment planning must take this into account.
 - Patients in the early stages of the disease (memory loss, anxiety) have a greater likelihood for accommodating to oral hygiene regimens and new prostheses.
 - In later stages (disorientation, personality changes), more definitive treatments might be necessary, such as extracting questionable teeth and limiting prosthetic care to immediate dentures, or relining or replacement of existing prostheses.
 - In terminal stages (non-ambulatory, total care), treatment might be limited to removal of severely diseased and/or inaccessible teeth and management of symptomatic mucosal disease.
- Impaired self care: The caregiver should be involved in oral hygiene instructions and insertion/removal/care of prostheses. Fluoride rinse/gels and salivary substitute may be used if indicated, along with frequent recalls.
- Facial pain: The presence of facial pain can be challenging to determine, and there is little in the literature on this. Some clues are the patient holding or rubbing the face in the area of the source, a limited movement of the jaws, or uncooperative behavior or resistance to examination while in the dental chair.
- Adverse behavior: Nonpharmacological management strategies should be attempted first. Schedule treatment at a time of day when the patient is known to display the most cooperative behaviors. Have a familiar person (e.g., spouse, nurse) present, at least initially. Explain the upcoming treatment steps in concrete, simple terms, one step at a time (e.g., "I am going to put something cold into your mouth. Now I am going to pull on your cheek."). Minimize distractions such as conversation not involving the patient, music, interruptions, etc. If this approach fails, consider oral, short half-life anxiolytic drugs such as alprazolam, lorazepam, or oxazepam (Appendix 12, Table 12-4). In advanced or otherwise unmanageable cases, sedation or even general anesthesia might be necessary.

Degenerative Neuromuscular Disorders

Classification: Muscular Dystrophies

The muscular dystrophies are genetic disorders involving voluntary muscle with progressive weakness and wasting. Muscle fibers are replaced by fatty and fibrous tissue. The prognosis depends on the type of dystrophy. Typically patients die of respiratory failure or cardiomyopathy. Other clinical findings include scoliosis, muscle contractures, pseudohypertrophy of the calves, and varying degrees of cognitive impairment. There are a number of types: Duchenne (which affects males only), Becker, and those based on the affected muscle groups.

- Duchenne muscular dystrophy is an X-linked disorder caused by mutation of the dystrophin gene. Two-thirds of mothers of isolated cases are carriers, 50% of female siblings are carriers, and 50% of sons are affected. Clinical presentation is earlier and more severe than others. Patients are often wheelchair-bound by early adolescence and die in their third decade.
- Becker muscular dystrophy is a less severe variant. The survival is longer than with Duchenne.
- Facioscapulohumeral type affects the masticatory muscles more than the other facial muscles, leading to weakness of the circumoral muscles and so-called “transverse smile.”

Dental Considerations

- The swallowing reflex can be affected and oral clearance is poor, so good suction is essential during treatment to avoid aspiration.
- General anesthesia is contraindicated because it requires ICU admission, possibly for weeks, postoperatively.
- The dosage of local anesthesia is reduced due to tolerance.
- Malocclusions can arise as a consequence of altered soft tissue balance.
- Flaccid soft tissues, an open-mouth posture, and muscle weakness can result in poor oral hygiene.

Myasthenia Gravis

Myasthenia gravis (MG) is an autoimmune disorder characterized by weakness and fatigability of skeletal muscles caused by antibody-mediated attack against acetylcholine receptors. It is provoked by infection or stress. It can occur at any age but there tends to be a bimodal distribution with an early peak in the second and third decades and a late peak in the sixth to eighth decades. A transient form known as neonatal MG (distinguished from congenital myasthenia) occurs when antibodies cross the placenta and cause joint contractures and other deformities.

Features

- Ocular muscle weakness: Ptosis or diplopia
- Bulbar muscle weakness: Difficulty in swallowing, speaking or chewing
- Neck or limb muscle weakness
- Respiratory muscle weakness that can be life-threatening

Treatment

- Symptomatic treatment with anticholinesterase drugs (e.g., pyridostigmine) provides variable response. Rare side effects of cholinergic crisis through overdose include hypersalivation, lacrimation, increased sweating, vomiting, and miosis.
- Available evidence suggests that the thymus plays a role in the pathogenesis of MG, and thymectomy in patients under 60 years of age is associated with MG improvement or remission.
- Immunotherapy with prednisolone and other agents, most commonly azathioprine, mycophenolate mofetil, or cyclosporin, are used in patients who remain symptomatic on pyridostigmine.
- Myasthenic crisis is life-threatening neuromuscular respiratory failure, often coupled with bulbar weakness compromising the airway. Immediate airway control, ventilatory support, and nasogastric intubation are needed. Plasma exchange or IV immunoglobulin is required for short-term control of symptoms with concurrent initiation of immunomodulating therapy to transition to long-term use after the crisis resolves.

Dental Considerations

- Patients might be on atropine to reduce the salivary secretions.
- There may be a risk of aspiration. Due to difficult airway control use of a rubber dam and efficient suction is essential.
- Be aware of the potential for drug interactions, as well as for cholinergic crisis.
- Drugs (including procaine, erythromycin, gentamicin, neomycin, polymyxin B, bacitracin, and clindamycin) may acutely potentiate myasthenic weakness. All local anesthetics should be used with caution.
- Long-term atropine can result in dry mouth sequelae of dental caries.
- Minimize oral infection and psychological stress. Arrange short appointments in the morning or one to two hours after ingestion of oral anticholinesterase medication to minimize fatigue and take advantage of greater muscle strength in the morning. Presurgical plasma exchange might be recommended for the myasthenic with severe exacerbations.
- Lipomatous atrophy can result in a furrowed and flaccid clinical appearance. Attempts at smiling may result in a snarl.
- Lack of strength in the muscles of mastication can inhibit chewing. Dysphagia may result in poor nutritional status, dehydration, and hypokalemia.
- Patients with poorly controlled myasthenic gravis might need oral hygiene aids and/or might have difficulty managing complete dentures.

Motor Neuron Disease

Motor neuron disease is a progressive condition of older people. Its origin is unknown and it involves degenerative changes in anterior horn cells, cranial nerve nuclei, and the pyramidal pathway. It is characterized by bulbar or pseudobulbar palsy: lower cranial nerve involvement, weakness of head and neck muscles, and eating and swallowing difficulties.

Dental Considerations

These are similar to other conditions in which airway impairment is profound. Refer to the above sections on myasthenia gravis and muscular dystrophy.

Multiple Sclerosis

Multiple sclerosis (MS) is the most common autoimmune demyelinating disease of central nervous system affecting young adults (age 20 to 40 years), the majority of whom are female. It is characterized by periods of remission and relapse. The cause is unknown.

Classification

The pattern and course of the disease are classified using standard terminology as follows:

- Relapsing remitting (RMMS), 90% cases at onset: Characterized by clearly defined relapses followed by full or partial recovery, without disease progression between relapses. Accounts for the vast majority of cases at onset; most ultimately progress to secondary progressive phase (SPMS).
- Primary progressive (PPMS), 10% cases at onset: Characterized by steady decline in function from onset with occasional improvements but no real remission. Has worse prognosis compared with RRMS.
- Progressive relapsing (PRMS): Characterized by steady decline from onset with relapses, followed by full or partial recovery with disease progression between relapses.
- Secondary progressive (SPMS): Progression from RRMS with or without occasional relapses, minor remissions, and plateaus.

Signs and Symptoms

The signs and symptoms depend on the area of the central nervous system affected and extent of demyelination:

- Fatigue, transitory weakness
- Sensory disturbance affecting a limb
- Heat sensitivity
- Cognitive effects: Personality, mood, depression
- Coordination: Tremor (cerebellum), vertigo
- Vision (optic neuritis or diplopia)
- Dysphagia
- Slurred speech and hearing defects (cranial nerve)
- Breathing, bladder and bowel control (pyramidal tract)
- Motor control (spinal cord)
- Chronic pain
- Sensory neuropathy and facial palsy (trigeminal)
- Lateral gaze defect
- Abnormal perioral hypersensitivity or anesthesia

Treatment

- Physiotherapy
- The mainstay of medical therapy is immunosuppression to delay progression, while acute attacks are usually treated with corticosteroids. Oral baclofen, tizanidine, dantrolene, gabapentin, and diazepam may be prescribed to reduce muscle spasticity
- Cannabis can assist in spasticity and bladder control
- Other drug therapies and effects: Antidepressants, anticholinergics (incontinence), antihistamines (dizziness), antispasmodics, cytotoxics, and beta-interferon oral ulceration and blood dyscrasias
- Aggravating factors: Infections, anesthetics/operations, and other stressful events

Dental Considerations

- Trigeminal neuralgia or sensory changes in the face may be a presenting sign to a dentist.
- Side-effects from drugs include dry mouth, oral ulceration, and blood dyscrasias.
- Significant physical disability and use of a wheelchair complicate delivery of dental care.
- No causal link between mercury from amalgam fillings and MS has been established.

Neural Tube Defects

Neural tube defects are the second most prevalent congenital anomaly in the United States, after cardiac malformations, and result from the failure of the neural tube to close normally between the third and fourth week of conception. The causes are

multifactorial (e.g., environmental, genetics). Epilepsy is present in 25% of people with neural tube defects and 30% have intellectual impairment. Other consequences of neural tube defects include flaccid paralysis, spinal deformity (severe kyphosis or scoliosis), loss of sensation, and neurogenic bladder.

Types of Neural Tube Defects

There are several types of neural tube defects, which affect the spine or the cranium. Myelomeningocele (spina bifida) is the most common neural tube defect and is the most severe birth defect compatible with survival.

- Spinal defects
 - Spina bifida occulta: Seen only on X-ray, apparent in 50% of unaffected children, and of no consequence
 - Spina bifida cystica: Meningocele (meninges protrude through vertebrae in sac; rarely associated with hydrocephalus or a neurological defect) and myelomeningocele (spinal cord protrudes into the sac, usually in the thorax–lumbar region, at motor level L3 and above, frequently associated with hydrocephalus). Patients with hydrocephalus, unless arrested, have a shunt fitted with a valve to control the flow of cerebrospinal fluid (CSF) from the ventricles
- Cranial defects
 - Most severe cranial defects are incompatible with life. Some milder forms can be addressed surgically with varying degrees of cognitive and motor deficits.
 - Anencephaly: The congenital absence of a major portion of the brain, skull, and scalp due to failure of the cephalic part of the neural tube to close
 - Exencephaly: The skull and scalp are absent, with exteriorization of the abnormally formed brain
 - Encephalocele: Herniation of cranial contents through a skull defect
 - Anencephaly: Rare; characterized by a triad of occipital bone defect, cervical dysraphism, and fixed retroflexion of the fetal head

Dental Considerations

- Prevention of dental disease is crucial.
- There is no scientific data to support antibiotic prophylaxis for ventriculoatrial or ventriculoperitoneal shunts.
- There is an above average occurrence of latex allergy due to intermittent/continuous catheterization.
- Proficiency is needed in handling and moving skills for safe transfer of patients from the wheelchair to dental chair, preferably with a hoist or wheelchair adaptation of dental unit. Patients should be moved regularly, especially if there is a tendency for pressure sores.

Parkinson's Disease

Parkinson's disease (PD) is a central nervous system disorder caused by the progressive degeneration of dopamine-producing cells in the brain. Primarily a movement disorder, the symptoms include uncontrollable tremor (worsened by anxiety), rigidity, slowness of movement, and impaired control of the airway. Ultimately mood disorders, sleep disorders, and dementia can develop. It is the second most common neurodegenerative disease, after Alzheimer disease, affecting approximately 1 million Americans, nearly all of whom are over the age of 50.

Dental Considerations

- Impaired oral-care: Involve caregiver (spouse, relative, nurse) in oral hygiene instructions and insertion/removal/care of prostheses. Fluoride rinses/gels and frequent recalls will aid in preservation of the dentition
- Rigidity: Compromises transfer, mouth opening, and chair and head positioning
- Tremor and rigidity: Schedule dental appointments approximately two hours after antiparkinsonian medications
- May need to employ mouth props and moldable cervical pillows
- Poor control of oral secretions/swallowing dysfunction/airway control: Keep patients as upright as possible, above 45°. Use a rubber dam whenever possible and employ high-volume suction. The patient might already have a fine-bore suction to help clear secretions from the airway
- Short morning appointments may be best, soon after PD medication is given
- It has been suggested that local anesthetic agents should be limited to three cartridges of 2% lidocaine with 1:100,000 epinephrine/half hour.

Seizures and Epilepsy

An epileptic seizure is an episode of neurologic dysfunction in which abnormal neuronal firing is manifested clinically by changes in motor control, sensory perception, behavior, and/or autonomic function. Nonepileptic seizures are sudden changes in behavior that resemble epileptic seizures but do not have the typical neurophysiological changes that characterize epileptic seizures.

Epilepsy is the condition of recurrent, spontaneous, unprovoked seizures. Distinguish from reflex anoxic seizures, vasovagal syncope, breath-holding attacks, migraine, cardiac arrhythmias, Münchausen syndrome and “pseudo” seizures, all of which are provoked.

Etiology

Causes of epilepsy include genetic predisposition (one parent affected: 4% chance; both parents affected: 10% to 14% chance), genetic conditions (e.g., increased

prevalence in Sturge-Weber, Down, and fragile X syndrome), head trauma, brain tumors (1% to 2% of childhood epilepsy), stroke, intracranial infection, cerebral degeneration, congenital brain malformations, and inborn errors of metabolism. Other conditions with seizures as a feature are cerebral palsy, tuberous sclerosis, and von Recklinghausen's neurofibromatosis.

Classification

Partial (Focal) Seizure

- Types: Simple partial, complex partial, and secondarily generalized tonic-clonic
- Signs: Autonomic manifestations are common and include face flushing, drooling, increased blood pressure and pulse, and urination (differentiates from syncope)
- Post-ictal phase after seizure: Patient is confused and has headache (not seen with syncope)

Generalized Seizures

- Types:
 - Absence: Brief episodes of impaired consciousness with no aura and no postictal confusion. The duration is less than 20 seconds. They can occur 30 to 80 times/day. Staring is the main symptom. The seizures may be precipitated by hyperventilation. EEG has classic findings.
 - Tonic: Sudden onset extension or flexion of the head/trunk and/or extremities for several seconds. Often occurs in relation to drowsiness, shortly after person falls asleep or during waking hours.
 - Clonic: Rhythmic motor jerking movements with or without impairment of consciousness.
 - Myoclonic: Brief, arrhythmic, jerking motor movement lasting less than a second. These often cluster within a few minutes.
 - Primary generalized tonic-clonic (grand mal): The most common, the symptoms of these seizures are loss of consciousness first followed by apnea ("epileptic cry" as air is expressed), jaw muscle contraction, upward movement of eyes, dilated pupils, high amplitude/frequency movement of all extremities for three to seven minutes.

Significant Elements in the History

- Type of seizure and frequency
- Medication: Type, dose, frequency, and compliance
- Precipitating factors: Stress, pain, fever, anxiety, etc.
- Level of control: e.g., occur despite medications, or only when medications are not taken
- "Aura" before seizures: Not a common phenomenon but could serve as a warning for an impending seizure
- Loss of consciousness

- Facial trauma from falling
- Expected sequence of seizure episode and rescue medication

Dental Considerations

- No contraindications to routine dental care
- Awareness of staff of potential for seizure episodes, and measures to prevent and/or abort these occurrences
- Elective dental treatment should only be performed on patients with well-controlled seizures. Check level of seizure control at each dental visit
- Poorly controlled if seizures reported within the preceding two years
- Check potential for other drug interactions (e.g., aspirin, NSAIDs, antifungals and phenytoin, erythromycin with carbamazepine and valproate) (Appendix 12, Table A12-4).
- Status epilepticus (continuous seizure activity for more than 30 minutes) is a medical emergency requiring immediate attention. See Chapter 6 and Appendix 12, Table A12-12.
- Be aware of the adverse effects of seizure control drugs, such as oral ulceration (with ethosuximide, benzodiazepines), gingival hypertrophy (e.g., phenytoin), blood dyscrasias (e.g., sodium valproate), sedation, and pharmacokinetic interactions (Appendix 12, Table A12-4)
- Altered bone turnover/density: Can be due to underlying seizure history or medication
- Preventive care is vital because of medication effects (xerostomia, sugar-based liquid oral medicines, gingival hypertrophy, potential for dental trauma)

Orthopedic and Bone Disorders

Arthritis

Arthritis is a group of degenerative disorders affecting the joints. It can be inflammatory, mechanical, post-infectious, or idiopathic. It is often multifactorial. The most common type, osteoarthritis, affects millions of Americans, increasing in prevalence with increasing age.

Classification

Osteoarthritis

Osteoarthritis results from a complex interplay of multiple factors, including joint integrity, genetic predisposition, local inflammation, mechanical forces, and cellular and biochemical processes. The types are:

- Idiopathic: Localized (hands, feet, knee, hip, spine, temporomandibular joint) or generalized (involves three or more joint sites) forms

- Secondary osteoarthritis: Arthritis caused or worsened by specific conditions including but not limited to trauma, congenital or developmental disorders, rheumatoid arthritis, Paget disease, diabetes, and hypothyroidism
- Rheumatoid arthritis: Idiopathic, chronic, systemic, inflammatory polyarthritis. The pattern of symptoms, signs, and physical and radiographic findings differs from that of osteoarthritis with occasional overlap. Joint destruction is caused by degradation of ligaments, tendons, cartilage, and bone, leading to characteristic joint deformities. Morning stiffness of the affected joint is a typical feature.

Significant Elements of the History

- Use of salicylates (e.g., aspirin) or other anti-inflammatory agents: Record the drug name, dosage, and duration of use
- Patients with inflammatory arthritis may be on immunosuppressive therapy with disease-modifying antirheumatic drugs (DMARD) or steroids
- Prosthetic joint surgery
- History of cervical spine luxation

Dental Considerations

- Although there is altered platelet function from chronic use of salicylates or other nonsteroidal anti-inflammatory agents, recent studies suggest that there is no need to alter aspirin use for dental procedures, including extractions.
- Long-term corticosteroid therapy may result in adrenal insufficiency and a concern for increasing the dosage for stressful procedures (“stress dose steroids”). Discuss with the patient’s physician.
- Children with juvenile rheumatoid arthritis (JRA) and related conditions can have considerable erosion of primary teeth from chewing salicylates. If possible, they should be taught to swallow rather than chew medication(s). Fluoride might slow the process of erosion. Eroded primary teeth might require full coverage restorations.
- Severe JRA and related conditions can lead to temporomandibular joint disorders and impaired mandibular growth.
- Severe rheumatoid arthritis is a relative contraindication to hyperextension of the neck. In ankylosing spondylitis the neck vertebrae may be fused, with resultant rigidity.
- Problems with oral hygiene may occur secondary to impaired dexterity. Patients also may have difficulty rising from the dental chair without assistance. It is preferable to move wheelchair patients to a dental chair.

Prosthetic Joint Replacement

Significance of the Problem

- According to one report, between 600,000 and 1,141,448 prosthetic hips and knees alone were placed in 2009, and there are almost 6 million people in the U.S. with prosthetic joints.

- There is a longstanding concern about preventing bacterial seeding of a prosthetic joint from the oral cavity, but there are no data to suggest prophylactic antibiotics prior to dental treatment prevent joint infections. The risk from dental procedures is extremely low, but there are about 25 case reports, most of which are poorly documented. These infections are almost always caused by staphylococcus and other bacteria from a non-oral source. The risk of drug reactions and resistant bacterial strains from misuse of antibiotics likely outweighs any risk of bacteremia in the dental office.
- Rare cases of prosthetic joint infections may result from oral bacterial pathogens, most likely from naturally occurring bacteremia (e.g., tooth brushing, chewing food) rather than from dental office procedures.
- In 2003 a joint panel of the American Academy of Orthopedic Surgeons (AAOS), American Dental Association, and specialists in infectious diseases recommended:
 - Antibiotics prior to all invasive dental procedures for two years after replacement of a prosthetic hip joint. After two years, antibiotic coverage should be employed in immunocompromised patients or those on chronic steroids, insulin-dependent diabetics, rheumatoid arthritis patients, or those with a history of previous joint infection.
 - These recommendations were overturned by a statement from the AAOS in 2009. Since that time, representatives from the ADA and AAOS have completed an evidence-based review of literature and developed guidelines for clinicians. These guidelines were scheduled to go online at the ADA and AAOS websites and to be published by early 2013.

Significant Elements in the History

- Date of joint surgery
- Name of the surgeon
- Current or past use of steroids
- History of arthritis, diabetes, chemotherapy, and immune deficiency

Dental Considerations

- Dental evaluation and management of the patient with a prosthetic joint infection thought to have come from an oral source should include a thorough oral exam, full mouth series of radiographs, and treatment to eliminate potential sources of possible hematogenous route of bacteremia.
- Oral infections in patients with prosthetic joints should be promptly treated with agents such as clindamycin (Appendix 12, Table 12-4).
- Dentists have at least two options:
 - They may want to inform their prosthetic joint patients about: (a) the lack of scientific evidence to support antibiotic prophylaxis, and (b) the potential for a drug reaction to AP, so that the patient can make an informed decision.
 - They can discuss these patients with the patient's orthopedist and come to an agreement that antibiotic prophylaxis is unnecessary, and that they will follow the 2003 guidelines until a new joint consensus statement is approved.

If the orthopedist elects to follow the 2009 AAOS opinion statement and recommends AP for a patient who would not receive AP by the 2003 guidelines, then the dentist has the option to ask the orthopedist to write the prescription for antibiotics. The rationale for this is the contrast between the lack of evidence for the practice of AP and the very real concerns about drug reactions, resistant strains of bacteria, and costs to the health care system.

- The content of any discussions with patients and other clinicians should be recorded in the patient's dental record.

Osteogenesis Imperfecta

Osteogenesis imperfecta (OI) is a group of rare inherited connective tissue conditions of Type 1 collagen, characterized by increased bone fragility and lax joints. OI is classified into nine major subtypes based on multiple physical and radiographic characteristics. Typically, however, the disease is classified as mild, moderate to severe, or lethal based on severity and features; for example blue sclera (which is age dependent) and dentinogenesis imperfecta. Other similar inherited dentin defects include Ehlers–Danlos syndrome, vitamin-D-resistant rickets, vitamin-D-dependent rickets, and hypophosphatasia.

Associated Features

- Hearing loss
- Mitral/aortic valve defects
- Bruising
- Basilar skull deformities
- Wormian bones (small irregular cranial bones)

Dental Considerations

- Bisphosphonates (inhibitors of osteoclast-mediated bone resorption) are used to increase bone density, mobility and well-being; these are typically delivered for two to four years, although this varies (Appendix 12, Table A12-2)
- Dentinogenesis imperfecta occurs in 50% of cases with gray, discolored dentin; there is more marked discoloration in earlier erupting teeth and dentition
- Pseudo class III malocclusion
- Excessive wear and sensitivity necessitates full coronal coverage (or coverage with stainless steel crowns in primary dentition) to maintain occlusal vertical dimension

Paget Disease (Osteitis Deformans)

Paget disease is a common disorder of older males (4% of population older than 40 years). Bones in the skull, pelvis, spine, and long bones of the lower extremities

are most commonly affected. The maxilla and heavy long bones are more often affected. It is characterized by resorption and deposition of bone with the result of an overgrowth of impaired bone at some sites.

Etiology

The etiology is unknown, but familial studies suggest that genetic factors and viral infection may play a role.

Features

- Possibility of heart disease (e.g., aortic stenosis, conduction abnormalities)
- Bony deformity: Leg bowing, altered skull shape
- Warmth over affected area from increased vascularity
- Deafness from trapped nerves
- Osteoarthritis
- Bone pain and fractures
- Osteogenic sarcoma
- Serum Ca and PO₄ levels are normal but alkaline phosphatase is elevated from osteoblastic activity

Dental Considerations

- Jaw involvement: The maxilla may expand, altering the fit of prostheses.
- During the active phase of disease, bone is unusually vascular and dental extractions may result in excessive bleeding. Additionally, surgical removal is often indicated due to heavy cemental deposits on root surfaces.
- Ischemic bone in advanced disease can predispose to delayed healing and post-extraction infections.
- There is a risk for bisphosphonate-associated osteonecrosis.
- Radiographic findings: “cotton-wool” appearance of bone.

Osteomalacia

Osteomalacia is a defect of bone mineralization (rickets in growing bone/children). It is mainly seen accompanying a deficiency of vitamin D or altered vitamin D metabolism from inadequate dietary intake, renal disease, or anticonvulsant therapy. Treatment is provided by remedying the underlying cause and levels of vitamin D and calcium.

Features

- Bone fracture/deformity in children. The long bones are affected primarily in adults
- Bone pain and muscle weakness
- Chronic kidney disease

Dental Considerations

- Enamel abnormalities may be present in children with rickets. Teeth eruption is affected only if the disease is severe.

Osteopetrosis

Osteopetrosis is a rare condition, dominantly inherited (Albers-Schönberg disease), with autosomal recessive forms.

Classification

There are two major clinical patterns:

- Infantile osteopetrosis (malignant osteopetrosis)
- Adult osteopetrosis (benign osteopetrosis). It is the result of markedly decreased bone resorption leading to bony deformities. The marrow spaces are occluded, resulting in anemia. Adult osteopetrosis typically does not require treatment, but may need intervention from complications of the disease.

Dental Considerations

- In the infantile form, facial deformity is quite prevalent and tooth eruption is almost always delayed. There is a higher risk of osteomyelitis from dental infections.

Osteoporosis

Osteoporosis arises as a consequence of physiological loss of bone. It is accelerated by aging, estrogen decline in postmenopausal women, and immobility. Additional risk factors include chronic steroid use, smoking, low body weight, Caucasian race, and family history. Endocrine disorders causing dysregulation of calcium, parathyroid hormone, and vitamin D can also cause osteoporosis. Prevention through behavior modification and weight-bearing exercise is recommended. Bisphosphonate therapy is the first line of pharmacologic therapy.

Significance of the Problem

- Patients are at increased risk for fractures, which is associated with significant impact on quality of life.
- It is a public health issue because of the aging population.

Dental Considerations

- Treatment with oral bisphosphonates can rarely result in osteonecrosis of the jaw bones, especially after five years of therapy.

- Because of the morbidity associated with this condition, it is recommended that patients visit their dentist prior to starting bisphosphonate therapy.

Pregnancy

Pregnancy presents a unique set of management considerations for dentists.

Dental Considerations

- “Pregnancy gingivitis”: Secondary to hormone changes and inadequate oral hygiene
- Pyogenic granuloma (pregnancy “tumor”): Can be excised, preferably postpartum. If small, it may shrink after delivery without intervention
- Timing of treatment: Elective treatment should be avoided in the first trimester because of concern for susceptibility to teratogens and spontaneous abortion. Dental prophylaxis and non-deferrable dental treatment are best provided in the second trimester. Elective procedures are not recommended in the third trimester primarily due to discomfort of lying in a dental chair and compromised venous return from fetal compression of inferior vena cava in the supine position
- Prolonged time periods in a dental chair can increase the risk of thromboembolic event
- Concern about risks from periodontal disease (e.g., low-birth-weight infants, premature birth) has been allayed by recent published studies in peer reviewed journals

Radiographs

Although the risk is from radiographs is negligible, they can usually be deferred until postpartum, unless they are needed for diagnosis of an acute problem (e.g., periapical film). During the first trimester, radiographs should be taken only for emergency care, and a double lead apron may be used for psychological well-being.

Drug Administration During Pregnancy and Breast Feeding

The FDA has a ranking of drugs based on the degree to which available information has ruled out in terms of risk to the fetus balanced against the potential benefits of the drugs to the patient (Appendix 12, Tables A12-9 to A12-11).

Psychiatric Disorders

The Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM IV) is a valuable resource for detailed information on psychiatric disorders. The

etiology of these distinct and sometimes related disorders is multifactorial. Some of the common psychiatric diagnoses include anxiety disorders (e.g., posttraumatic stress disorder), mood disorders (e.g., depression, bipolar), eating disorders (e.g., anorexia), personality disorders (e.g., narcissistic personality disorder, obsessive compulsive personality disorder), impulse control (e.g., kleptomania), and addiction disorders.

Dental Considerations

- Many of these patients with uncontrolled symptoms can be uncooperative or difficult to interview and it is therefore important to verify whether the patient has adequate decision-making capacity to provide valid informed consent due to illness or drugs.
- It is important to know and record the type and dosage of the medications the patients are taking.
- Alprazolam or buspirone may be effective in limiting movements during dental treatment.
- Use non-opioid analgesics if possible.
- Tardive dyskinesia is caused by phenothiazines, butyrophenones (used commonly for schizophrenia), and less frequently by metoclopramide and tricyclic antidepressants. These involuntary movements can compromise the success of complete dentures.
- Precautions exist for the use of sedatives, opioids, epinephrine, and other drugs that could interact with the patient's medications.
- Xerostomia is a probable side effect of neuroleptic and other behavior-managing medications, and patients are at high risk for dental caries. The patient should be on a rigorous recall schedule and have dietary counseling, with particular attention to refined carbohydrate intake. Use fluoride supplementation with dentifrice, rinses, gels, or mouth trays (Appendix 24, Table A24-2). Involve the caregiver in all preventive and oral hygiene counseling.
- All dental restorations placed in patients with uncontrollable movements should be designed to offer maximal resistance to shearing stresses. Balancing contacts should be avoided; working side contacts are only advisable if part of a group function.

Renal/Adrenal Disorders

Adrenal Disorders

Hyperadrenocorticism (Cushing's Syndrome)

Hyperadrenocorticism is a constellation of signs and symptoms caused by various endogenous (e.g., pituitary, adrenal) or exogenous (e.g., long-term steroid use) conditions leading to hypersecretion of the glucocorticoid cortisol. Features include:

- Hypertension, muscle weakness, “moon facies,” truncal obesity, hirsutism, “buffalo hump,” psychological disturbance
- Diabetes, osteoporosis, bleeding diathesis (microcirculation does not respond appropriately). The result can be poor wound healing, easy bruising, and increased risk of infection.

Hypoadrenocorticism (Addison’s Disease)

Hypoadrenocorticism is hyposecretion of the glucocorticoid cortisol as a result of autoimmune destruction of the adrenal cortex, exogenous steroid therapy, therapeutic bilateral adrenalectomy, or damage to the pituitary gland. Features include:

- Hyperpigmentation: Buccal and labial mucosa and gingivae, loss of appetite
- Weakness, fatigue, malaise, mental confusion, depression, weight loss, fever, orthostatic hypotension, syncope (sodium depletion), depressed vasoconstrictor response

Signs and Symptoms

- Poor response to stress; could precipitate cardiovascular collapse
- Nausea and vomiting, weakness, thirst, polyuria, hypoglycemia, hyperkalemia, dehydration, hypotension, abdominal pain, confusion, loss of consciousness, convulsions, arrhythmia, cardiac arrest

Dental Considerations for Adrenal Insufficiency

See Appendix 12, Tables A12-14 and A12-15.

- Adrenal crisis is precipitated by stress (e.g., trauma, surgery, infection), and potentially from abrupt withdrawal of steroids.
- There is a longstanding concern about adrenal crisis in the dental office, and covering patients exposed to steroids in the recent past or those currently taking steroids. The concern over this issue has clearly been exaggerated given the absence of well documented, published cases of this happening. The two to three cases that have been reported were during general anesthesia and no cortisol levels were drawn to document the cause. There have been no case reports of patients having procedures under local anesthetics. The more significant risk for adrenal crisis comes from hypovolemia.
- Rules that prescribe doses and durations of steroid use that require increased steroid coverage for dental procedures (e.g., “Rule of 2s”) generally have little basis in science.
- Although giving patients prednisone for stressful dental procedures poses little, if any risk, there have been no case reports of adrenal crisis from sudden withdrawal from less than 7.5 mg of prednisone.
- It is prudent to cover patients undergoing stressful dental procedures who are taking 50 mg prednisone and those with Addison’s disease.

- Management may include:
 - Evaluate for hypovolemia
 - If steroid replacement is deemed appropriate, some clinicians:
 - Give 40 to 50 mg PO an hour before the procedure (or 100 mg hydrocortisone IV) and they may consider additional replacement six hours later if the patient is expected to be in pain, as he or she may have depleted his or her endogenous steroids at this point, or
 - Double the oral dose the day before, morning of, and day after the procedure, or give 100 mg Solu-Medrol® IV the day before, morning of, and day after the procedure
 - An IV line in place will allow for administration of fluids and medications should they be needed during a procedure.
 - Keep the procedure as non-stressful as possible and provide appropriate postoperative medications for pain control.

Renal Disorders

Drug Therapy in Renal Failure

Renal patients are often on multiple drugs to manage both the renal disease and its complications. The dosage or frequency of administration of a given drug may have to be adjusted to obtain therapeutic drug levels in the blood due to altered renal clearance and dialysis. Drugs that are metabolized by the kidneys should be avoided or used with caution (Appendix 12, Table A12-15).

Dental Considerations for Renal Patients

Renal Dialysis

- Antibiotic prophylaxis: Dialysis patients are at risk for uremic (chemical trauma) heart valve damage but antibiotic prophylaxis is not recommended by the 2007 American Heart Association guidelines. Antibiotic prophylaxis prior to invasive dental treatment for protection of the dialysis shunt or the transplanted kidney has been suggested but supportive data are lacking (Appendix 23, Table A23-1).
- Do not measure blood pressure in the arm with a shunt.
- Penicillins are acceptable for short-term use (several days) but not for long-term use, due to high potassium levels. When appropriate, other antibiotics can be used. Nephrotoxic medications (e.g., aminoglycosides, tetracyclines, and cephalosporins) should be avoided.
- Ideally, dental appointments should occur on the day following dialysis. Patients are usually tired after dialysis. The concern about the heparin needed to prevent clotting of the vascular access shunt and its impact on bleeding complications is likely overstated, because the dose is small and the half life of heparin is short.
- Patients might be chronically anticoagulated due to the increased risk of thromboembolic disease. Coagulation status should be verified prior to surgical procedures (e.g., PT/INR if the patient is on warfarin, aPTT if the patient is on heparin).

- Patients may have failing platelet function due to renal failure and concomitant uremia.
- There is a higher incidence of hepatitis B and C and anemia.
- The serum calcium/phosphorus ratio is altered and there is an increased risk of the development of tertiary hyperparathyroidism, which can present with osteolytic “Brown tumors” of the jaws.
- Chronic uremia can lead to oral mucosal lesions.

Renal Transplant

- Patients are on lifelong immunosuppressive therapy. Although steroid prophylaxis may be considered for adrenal insufficiency, there is no data to support the use of antibiotic prophylaxis for dental procedures.
- Watch for gingival overgrowth if the patient is taking cyclosporine.
- Oral infection should be treated aggressively and may require hospitalization for IV antibiotics and closer monitoring of infection (airway, etc.).
- Exercise caution in the use of drugs requiring renal clearance (Appendix 12, Table A12-15).

Respiratory Disease

Cystic Fibrosis

Cystic Fibrosis (CF) is the most common inherited disease in Caucasians. It is caused by mutation of the cystic fibrosis transmembrane conductance regulator gene. This results in abnormal transport of chloride and sodium across the respiratory epithelium, causing thickened, viscous airway secretions. Diagnosis is often made by the high level of chloride ions in the sweat. One in 10 patients in the U.S. are not diagnosed until adulthood. The median survival is 30 years.

Features

- Respiratory: Progressive bronchiectasis, repeated pneumonias, hemoptysis, pneumothorax, nasal polyposis, chronic sinusitis, finger clubbing (adults)
- GI tract: Neonatal meconium ileus (distal intestinal obstruction syndrome), rectal prolapse, pancreatic insufficiency (up to 15% of CF children are pancreatic sufficient), focal biliary cirrhosis/portal hypertension
- Endocrine/reproductive: Diabetes mellitus, male infertility

Treatment

- Patients are on multiple medications for pancreatic supplementation, prophylaxis against *Pseudomonas aeruginosa*, macrolides (e.g., azithromycin) for anti-inflammatory action, bronchodilators for airway obstruction, nebulized dornase alfa (decreases viscosity of sputum)

- Transplant of cadaveric donor heart–lung or double-lung gives a current one-year survival of 80%; three-year survival = 50%. Living transplant: Related lobe donation to overcome transplant shortage needs two donors, usually blood relations—lower lobectomy.

Dental Considerations

- Salivary gland enlargement
- Enamel hypoplasia due to high pH of saliva
- Delayed eruption
- Relative caries resistance due to high pH of saliva, tendency therefore to accumulate calculus deposits
- Some older patients may have tetracycline-stained teeth

Asthma

Asthma is a chronic inflammatory respiratory disease characterized by episodic and reversible acute or subacute narrowing of the airways, or bronchospasm. Decreased ciliary activity and increased secretions are early manifestations followed by an inflammatory reaction. There is constriction of smooth muscle with edema of bronchial mucosa and formation of tenacious mucous, predisposing to infection.

Classification:

Extrinsic (Allergic) Asthma

- Usually occurs in children and young adults; usually inherited predisposition
- Attacks are usually precipitated by specific allergens such as dust; feathers; animal dander; fungal spores; plant pollen; foods; and drugs such as aspirin/NSAIDs, penicillin, and barbiturates. Attacks may disappear after adolescence
- Airway obstruction usually develops within minutes of exposure to allergen
- Immunoglobulin E antibodies produced: Type I hypersensitivity reaction

Intrinsic Asthma

- Half of all asthmatics: Usually develops in adults. Usually more severe than the extrinsic type.
- Usually precipitated by nonallergic factors such as infection, air pollutants, smoke, cold air, exercise, stress, emotional upset, or physical exertion

Features

Attacks are characterized by wheezing and rarely cyanosis. There may be shortness of breath, cough, tachypnea, a prolonged expiratory phase, or apprehension.

Significant Elements in the History

- Frequency and severity of attacks: Hospitalizations and/or frequency of emergency room visits
- Precipitation of attacks: Stress is an important factor in dentistry, along with cold air, pollutants, respiratory infection, exercise, aspirin, medical non-compliance. For younger children, viral respiratory tract infections are the major trigger of attacks.
- Medications used and response to medications: Patients with severe asthma are often on steroids (Appendix 12, Table A12-1)
- Use of nebulized beta-agonists (isoproterenol, albuterol in acute episodes) (Appendix 12, Table A12-4)

Dental Considerations

- Avoid treatment during respiratory infection.
- Keep the appointments short.
- NSAIDS including aspirin should be avoided in asthmatic patients because of the preferential generation of leukotrienes associated with their use and the increased incidence of aspirin sensitivity (5%) in asthmatics.
- Minimize the use of epinephrine.
- Ask the patient to bring medications (specifically albuterol inhaler) to each appointment.
- Consider prophylaxis with an albuterol puff prior to treatment.
- Eliminate stress as much as possible. Sedation may minimize the risk of attacks.
- Patients might be taking drugs between attacks to avoid recurrence.
- If patients are taking theophylline or aminophylline, use of erythromycin or clindamycin will increase the theophylline level and may result in theophylline toxicity.
- Consider the use of antibiotics if the patient is on steroids or if there is a risk of oral infection complicating medical management.
- Consider hospitalization for dental care if the patient is moderate to high risk.
- Management of attack (Chapter 6):
 - Stop the procedure and allow the patient to sit upright.
 - Have the patient use a beta-agonist inhaler (multiple puffs). Doses higher than prescribed are safe in acute episodes (four to eight puffs).
 - Monitor pulse if the patient is moderate-risk.
 - Consider supplementing oral steroids in a patient with history of steroid use.

Chronic Obstructive Pulmonary Disease

Chronic obstructive pulmonary disease (COPD) is a general term to describe pulmonary diseases that are characterized by chronic airflow restriction to the lungs that is not entirely reversible. It is the fourth-ranked cause of death in the U.S. The two most common diseases in this category are chronic bronchitis, which is obstructive

tion caused by narrowing and collapse of the small airways, increased sputum production and mucous plugging, and emphysema, which is damage to the alveolar epithelium causing loss of elastic recoil of the lungs. The most common cause of COPD is cigarette smoking.

Dental Considerations

- Patients may be taking steroids. Be alert for the possibility of adrenocortical insufficiency and oropharyngeal candidiasis. Consider the need for steroid supplementation for stressful procedures, and antibiotics for active oral infection (Appendix 8, Table A8-4, and Appendix 23, Table A23-3).
- Patients may be on theophylline or aminophylline; use of erythromycin should be avoided because it will result in increased theophylline levels and possible toxicity.
- Avoid sedatives, tranquilizers, hypnotics and opioids. Avoid high-flow oxygen because it could take away respiratory “drive.”

Tuberculosis

Tuberculosis (TB) is one of the least transmissible respiratory diseases. Multidrug-resistant (MDR) TB strains have evolved for a variety of sociocultural, economic, and geopolitical reasons. MDR-TB is more prevalent in the HIV-infected population.

Dental Considerations

- Avoid elective treatment in patients with active disease or positive sputum or who are still coughing. Refer the patient to a physician for evaluation if unsure of status.
- Most patients have negative sputum cultures after three to four weeks of therapy (streptomycin, isoniazid, rifampin, ethambutol, etc.) and are non-infective.
- Given the emergence of multidrug-resistant forms, masks must be worn as a preventive measure.

Sickle-Cell Anemia

Significance of the Problem

Patients with sickle-cell anemia may experience crises, which can be vaso-occlusive (sickled red blood cells block small blood vessels), sequestration (large amounts of blood accumulate in the liver or spleen), or aplastic due to failure of bone marrow production.

Classification

- Sickle-cell trait (heterozygosity for a hemoglobin S mutation of the beta hemoglobin chain) is a benign carrier condition. Usually asymptomatic and serious complications are rare.
- Sickle-cell anemia (homozygous hemoglobin S). Caused by hypoxia-induced polymerization of the abnormal hemoglobin S molecule, followed by red blood cell sickling, with resultant microvascular occlusion. The mechanism for acute episodes of vaso-occlusion is unresolved and far more complicated than just cell sickling due to hypoxia or infection.
 - Patients have chronic anemia and acute painful episode or “crisis.”
 - Vaso-occlusive crises are most common, and can be triggered by local or systemic hypoxia and infection. Some of the complications due to vaso-occlusive crisis include stroke and bone, chest, and abdominal pain.

Significant Elements of the History

- Frequency and type of crisis: number of hospitalizations and reason for each
- Complications and deficits from previous sickle cell crises (e.g., deficits from stroke)
- History of transfusions
- Laboratory values (hemoglobin, hemoglobin electrophoresis, hematocrit)

Oral Manifestations

- Mucosal pallor (from chronic anemia), jaundice (from hemolysis), hypoplastic enamel, and delayed eruption of teeth may be seen.
- Enlargement of marrow spaces may result in abnormal alveolar trabeculation pattern on radiographs and a class II malocclusion (due to enlargement of the maxilla).
- Mental nerve neuropathy and non-specific dental pain (due to vaso-occlusive effect on the small vessels of the dental pulp) can occur.

Dental Considerations

- The major concern is for acute oral infection and/or pain that can precipitate a sickle-cell crisis.
- Emphasis should be on preventive dental care because of the serious sequelae of infection.
- Vascular crisis may manifest as dental pulpal pain.
- Local anesthesia:
 - Agents associated with methemoglobinemia (e.g., prilocaine) should be avoided.
 - Use of vasoconstrictors is controversial. The benefits of vasoconstrictors probably outweigh the risk of local impairment of circulation in most cases. Concentrations of epinephrine greater than 1:100,000 should be avoided.

- General anesthesia, when necessary, may be preceded by blood transfusion by the patient's physician or hematologist. In general, raising the pre-operative baseline hemoglobin level to more than 10 g/dL (but less than 12 g/dL) may provide some protection against complications.
- Nitrous oxide may be used for sedation, but oxygen must be 50% or greater. Avoid excessive barbiturates and strong narcotics that could suppress respiration because hypoxemia is a trigger for a sickle cell crisis.
- Surgical removal of the spleen or autosplenectomy from multiple infarcts can result in reduced filtration of encapsulated organisms. Antibiotic prophylaxis for dental procedures has been suggested by some sources, but data to show any benefit are lacking.

Disorders of the Thyroid Gland

Hyperthyroidism

Uncontrolled hyperthyroidism is associated with several symptoms including weakness, heat intolerance, anxiety, tremor, palpitations, sweating, and weight loss. The most common cause of hyperthyroidism is Graves disease, and it affects more women than men. Exophthalmos is an irreversible physical finding seen in some cases of Graves disease.

Significance of the Problem

Although rare, thyrotoxic crisis (thyroid storm) may be precipitated by dental treatment, acute infection, or trauma in uncontrolled hyperthyroidism.

Dental Considerations

- Manage pain and infection aggressively (i.e., antibiotics/analgesics).
- Look for evidence of thyrotoxicosis: Fever, altered mental status, tachycardia, hypertension.
- In well-controlled patients, the majority of treatment can be carried out without any additional precautions; however, consider discussing more stressful procedures with the patient's physician.
- Prevention of infection is important to avoid a crisis.
- Avoid any dental treatment for patients with untreated or incompletely treated thyrotoxicosis.
- Use caution with the use of epinephrine or other pressor amines which could potentially cause a hypertensive crisis.

Hypothyroidism

Hypothyroidism is decreased secretion of thyroxine (T4) and triiodothyronine (T3) from the thyroid gland caused by disruption of the hypothalamic-pituitary-thyroid

axis. This leads to an increase in thyroid stimulating hormone (TSH), the lab value commonly used to measure thyroid function. It is often caused by Hashimoto thyroiditis or can be iatrogenic following radioactive iodine therapy for hyperthyroidism. Uncontrolled hypothyroidism presents with symptoms including cold intolerance, weight gain, hair loss, constipation, and depression, and in extreme cases can lead to myxedema coma.

Significance of the Problem

Patients may have a poor response to stress, infection, and trauma resulting in hypothyroid coma.

Dental Considerations

- Signs include hypotension, bradycardia, cold intolerance, decreased temperature.
- Use caution with sedatives and opioids.

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Suggested Reading: Seizures and Epilepsy

Texts

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Suggested Reading: Orthopedic and Bone Disorders/Arthritis

Texts

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Suggested Reading: Prosthetic Joint Replacement

Text

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Suggested Reading: Osteogenesis Imperfecta

Texts

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Suggested Reading: Paget Disease (Osteitis Deformans)

Texts

- Favus MJ, Vokes TJ. Chapter 355, Paget's Disease and Other Dysplasias of Bone. In: *Harrison's Online (Harrison's Principles of Internal Medicine)* (18th Ed.). Longo DL, Fauci AS, Hauser SL, Jameson JL, Loscalzo J (Eds.). McGraw-Hill, New York. 2012.
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Suggested Reading: Osteopetrosis

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Texts

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Suggested Reading: Renal/Adrenal Disorders

Texts

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Suggested Reading: Renal Disorders

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Suggested Reading: Respiratory Disease/Cystic Fibrosis

Texts

- Accurso FJ. Chapter 89, Cystic Fibrosis. In: *Goldman's Cecil Medicine*, 24th Ed. (pp. 544–548). Goldman L, Schafer AI (Eds.). Elsevier Saunders, Philadelphia. 2011.

Boucher RC. Chapter 259, Cystic Fibrosis. In: *Harrison's Online (Harrison's Principles of Internal Medicine)* (18th Ed.). Longo DL, Fauci AS, Hauser SL, Jameson JL, Loscalzo J (Eds.). McGraw-Hill, New York. 2012.

Suggested Reading: Asthma

Texts

- Barnes PJ. Chapter 254, Asthma. In: *Harrison's Online (Harrison's Principles of Internal Medicine)* (18th Ed.). Longo DL, Fauci AS, Hauser SL, Jameson JL, Loscalzo J (Eds.). McGraw-Hill, New York. 2012.
- Drazen JM. Chapter 87, Asthma. In: *Goldman's Cecil Medicine*, 24th Ed. (pp. 531–537). Goldman L, Schafer AI (Eds.). Elsevier Saunders, Philadelphia. 2011.

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- Alavaikko S, Jaakkola MS, Tjaderhane L, Jaakkola JJ. Asthma and Caries: A Systematic Review and Meta-Analysis. *American Journal of Epidemiology*. 174(6):631–41, Sep 15. 2011.
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Suggested Reading: Chronic Obstructive Pulmonary Disease

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- Niewoehner DE. Chapter 88, Chronic Obstructive Pulmonary Disease. In: *Goldman's Cecil Medicine*, 24th Ed. (pp. 537–544). Goldman L, Schafer AI (Eds.). Elsevier Saunders, Philadelphia. 2011.
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Suggested Reading: Tuberculosis

Texts

- Ellner JJ. Chapter 332, Tuberculosis. In: *Goldman's Cecil Medicine*, 24th Ed. (pp. 1939–1948). Goldman L, Schafer AI (Eds.). Elsevier Saunders, Philadelphia. 2011.
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Suggested Reading: Sickle-Cell Anemia

Texts

- Benz EJ. Chapter 104, Disorders of Hemoglobin. In: *Harrison's Online (Harrison's Principles of Internal Medicine)* (18th Ed.). Longo DL, Fauci AS, Hauser SL, Jameson JL, Loscalzo J (Eds.). McGraw-Hill, New York. 2012.
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Steinberg MH. Vasoocclusion in Sickle Cell Disease. UpToDate. Schrier SL, Landaw SA (Eds.). <http://www.uptodate.com>.

Suggested Reading: Disorders of the Thyroid Gland**Texts**

Jameson JL, Weetman AP. Chapter 341, Disorders of the Thyroid Gland. In: *Harrison's Online (Harrison's Principles of Internal Medicine)* (18th Ed.). Longo DL, Fauci AS, Hauser SL, Jameson JL, Loscalzo J (Eds.). McGraw-Hill, New York. 2012.

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Texts

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Suggested Reading: Degenerative Neuromuscular Disorders

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- Amato AA, Brown RH. Chapter 387, Muscular Dystrophies and Other Muscle Diseases. In: *Harrison's Online (Harrison's Principles of Internal Medicine)*, 18th Ed. Longo DL, Fauci AS, Hauser SL, Jameson JL, Loscalzo J (Eds.). McGraw-Hill, New York. 2012.

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Suggested Reading: Motor Neuron Disease**Texts**

- Aminoff MJ. Chapter 24, Nervous System Disorders. In: *Current Medical Diagnosis and Treatment*, 49th Ed. (pp. 920–921). McPhee S, Papadakis M (Eds.). McGraw-Hill Medical, New York. 2010.
- Brown RH. Chapter 374, Amyotrophic Lateral Sclerosis and Other Motor Neuron Diseases. In: *Harrison's Online (Harrison's Principles of Internal Medicine)* (18th Ed.). Longo DL, Fauci AS, Hauser SL, Jameson JL, Loscalzo J (Eds.). McGraw-Hill, New York. 2012.
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Texts

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Suggested Reading: Neural Tube Defects

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Suggested Reading: Seizures and Epilepsy

Texts

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Suggested Reading: Orthopedic and Bone Disorders/Arthritis

Texts

- Felson DT. Chapter 332, Osteoarthritis. In: *Harrison's Online (Harrison's Principles of Internal Medicine)* (18th Ed.) Longo DL, Fauci AS, Hauser SL, Jameson JL, Loscalzo J (Eds.). McGraw-Hill, New York. 2012.

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Suggested Reading: Prosthetic Joint Replacement

Text

- MacKenzie CR, SU EP. Chapter 285, Surgical Treatment of Joint Disease. In: *Goldman's Cecil Medicine*, 24th Ed. (pp. 1753–1758). Goldman L, Schafer AI (Eds.). Elsevier Saunders, Philadelphia. 2011.

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Suggested Reading: Osteogenesis Imperfecta

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Suggested Reading: Paget Disease (Osteitis Deformans)

Texts

- Favus MJ, Vokes TJ. Chapter 355, Paget's Disease and Other Dysplasias of Bone. In: *Harrison's Online (Harrison's Principles of Internal Medicine)* (18th Ed.). Longo DL, Fauci AS, Hauser SL, Jameson JL, Loscalzo J (Eds.). McGraw-Hill, New York. 2012.
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Suggested Reading: Osteomalacia

Texts

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Suggested Reading: Pregnancy

Texts

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Suggested Reading: Renal/Adrenal Disorders

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Suggested Reading: Renal Disorders

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Suggested Reading: Respiratory Disease/Cystic Fibrosis

Texts

Accurso FJ. Chapter 89, Cystic Fibrosis. In: *Goldman's Cecil Medicine*, 24th Ed. (pp. 544–548). Goldman L, Schafer AI (Eds.). Elsevier Saunders, Philadelphia. 2011.

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Suggested Reading: Asthma

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Barnes PJ. Chapter 254, Asthma. In: *Harrison's Online (Harrison's Principles of Internal Medicine)* (18th Ed.). Longo DL, Fauci AS, Hauser SL, Jameson JL, Loscalzo J (Eds.). McGraw-Hill, New York. 2012.

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Alavaikko S, Jaakkola MS, Tjaderhane L, Jaakkola JJ. Asthma and Caries: A Systematic Review and Meta-Analysis. *American Journal of Epidemiology*. 174(6):631–41, Sep 15. 2011.

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Suggested Reading: Chronic Obstructive Pulmonary Disease

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Suggested Reading: Disorders of the Thyroid Gland

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Oral Medicine: A Problem-Oriented Approach

Oral medicine relates to the diagnosis and Management of a wide variety of non-surgical and mostly nonodontogenic problems of the oral cavity and maxillofacial region, principally including oral mucosal diseases, salivary gland disorders, and orofacial pain. These problems can be subdivided into those that are local vs. those that represent oral manifestations of systemic disease and medical therapy. Early recognition may increase the likelihood for a more favorable management of a number of medical conditions. A classic example of a local disease is an oral squamous cell carcinoma, which if detected early can have a major impact on a patient's mortality and morbidity. Similarly, systemic diseases can show characteristic oral signs and symptoms that can suggest undiagnosed or worsening disease, such as oral candidosis in HIV infection, oral ulcerations as the first signs of pemphigus vulgaris, or gingival infiltrates in undiagnosed leukemia.

The starting point in oral medicine, as in all clinical disciplines, is the history. Developing the skill—indeed the art—of taking a history that is succinct, relevant, but also comprehensive is essential. A careful history of the patient's chief concern will often tip off an experienced clinician to the diagnosis. A classic example is the history of excruciating paroxysms of electric-like pain triggered by eating or cold air hitting the face in an elderly woman with trigeminal neuralgia. The medical history is particularly important in order to have a thorough understanding a patient's medications (prescribed and otherwise), both from the standpoint of oral side effects of drug therapy and also from consideration of the interaction of medications prescribed to patients by different clinicians. A careful review of systems can also uncover undiagnosed problems, for example, an uncontrolled diabetic patient can present with a constellation of different symptoms ranging from frequent urination to numbness of the extremities. Eliciting both a social history of tobacco, alcohol, or illicit drugs use and a dental history including the types of oral health products used is also of paramount importance.

The historical data collection is followed by a careful clinical examination, both extra-oral and intra-oral. Indeed, the importance of the extra-oral examination is highlighted by the discovery of asymptomatic neck lymphadenopathy in an adult with an undiagnosed oropharyngeal cancer at the tongue base that might be impossible to appreciate during the intra-oral examination. Knowledge of how to evaluate cranial nerve function, assess salivary flow, and appreciate the nuances in the varied signs of mucosal pathology is also important. The synthesis of the history and clinical findings provides the diagnostic pathway allowing the clinician to move from a differential diagnosis, following appropriate investigations, to a definitive diagnosis and a management plan.

All oral medicine problems fall under one or more subjective complaints and/or objective signs. Patients may present with one or more of the following nine symptoms (i.e., subjective indicators): altered mucosa, pain/altered sensation, xerostomia/dry mouth, malodor, slow healing, swelling, bleeding, altered oral function (opening, eating, speaking, swallowing, etc.), or problems with teeth.

Based upon the examination, patients will have at least one of the following signs (i.e., objective indicators): altered mucosa, altered sensation, altered neuromuscular function, psychiatric/psychological problems, salivary hypofunction, changes in teeth or radiographs, or other objective findings (e.g., laboratory tests or imaging). Often, but not always, these subjective indicators map to objective indicators. There is much overlap and our attempt to classify these problems is imperfect.

This chapter serves as a problem-oriented approach to the more common oral medicine problems, and the approach is a categorization of these problems based upon presenting signs and symptoms. It is not intended as a substitute for textbooks of oral medicine or oral pathology.

Altered Mucosa

Altered mucosa can be a subjective and/or objective indicator of disease. Subjectively, a patient may sense a change due to pain/burning or another altered sensation (e.g., roughness or other change in texture felt with the tongue), or visualize a change through self-examination. Patients often are concerned about a bump, spot, patch, or sore. Alternatively, the clinician may detect an asymptomatic mucosal lesion of which the patient was unaware. Objectively, altered mucosa manifests as one or more lesions. Sometimes the subjective experience of altered mucosa is not commensurate with objective findings.

Oral Lesions May Be Localized or Generalized and Usually Present As:

- White
- Red
- Ulceration
- Exophytic changes
- Pigmented/color changes

White Lesions (or Lesions with a Predominantly White Component)

White lesions are the most commonly encountered lesions. Most are asymptomatic and generally the result of increased epithelial thickness due to trauma (i.e., hyperkeratosis and hyperplasia). The nature of white lesions is important given the malignant potential of some of them (Figure 3.1).

If the Lesion Rubs Away with Gauze

Consider pseudomembranous candidosis. Differential diagnosis includes reactive etiologies.

Pseudomembranous Candidosis

- Symptoms: Generally asymptomatic, although can cause a burning sensation
- History: Candidal infection, of any form or clinical presentation, is frequently a marker of underlying disease
 - Local causes: salivary hypofunction (see section on “Dry Mouth”), use of corticosteroid inhalants, altered local oral microflora secondary to the use of broad-spectrum antimicrobial agents

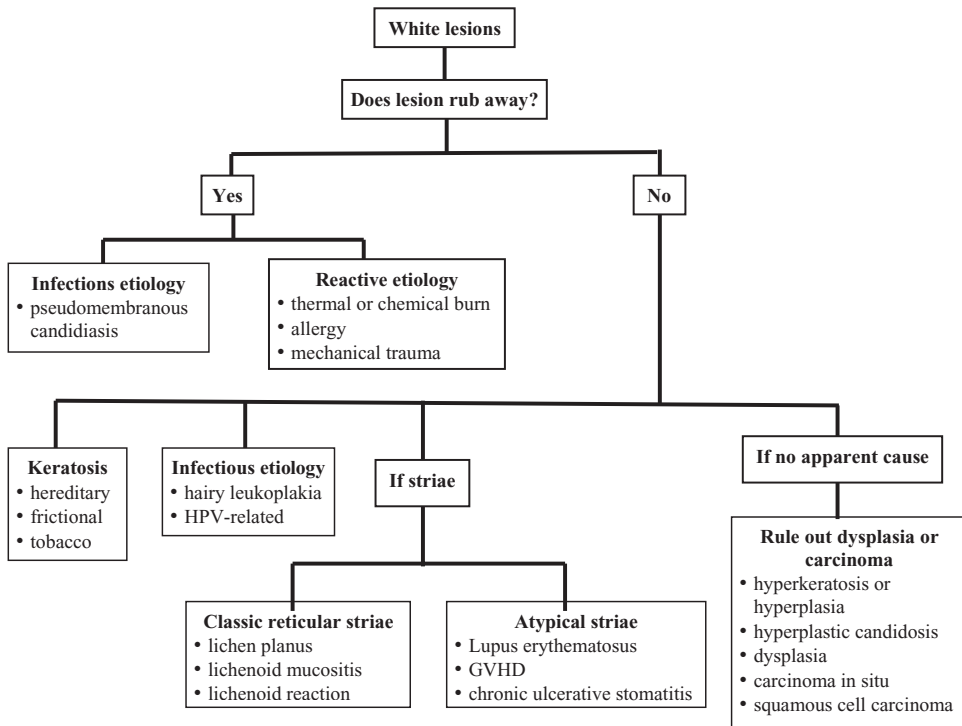


Figure 3.1. White lesions or those with a predominant white component.

- Systemic causes: Uncontrolled diabetes, immunosuppression secondary to cytotoxic agents, high-dose corticosteroid therapy, bone marrow impairment, or HIV/AIDS
- Signs: White, curd-like plaques may be wiped away; the underlying mucosa may be erythematous
- Diagnostics: If unsure of the clinical presentation, perform smear (KOH float or PAS stain). Cultures are not generally used for diagnosis unless unresponsive to treatment
- Treatment: Identify and correct contributing etiology. Local causes must be addressed and systemic causes screened for and identified (e.g., diabetes, HIV disease). Topical antifungals (e.g., clotrimazole troches, miconazole buccal tablets) or systemic antifungals (e.g., fluconazole) can be used depending on the extent of disease and the overall systemic health (Appendix 12, Table A12-4).

Reactive Etiologies

The etiology is most likely trauma, which may be thermal (e.g., pizza burn) or chemical (e.g., aspirin burn). An acute allergic reaction to an oral care product is possible. Note: Use of alcohol-containing mouth rinses can cause asymptomatic sloughing or peeling of mucosa.

- Symptoms: Possible pain or burning, but may be asymptomatic
- History: Recent trauma or use of a new oral care product
- Signs: White sloughing tissue with or without erythema
- Diagnostics: After excluding traumatic causes, consider stopping or changing any product that might have a temporal association with the onset of the lesion
- Treatment: Re-evaluate in two weeks; consider biopsy if no resolution or if etiologic agent is identified (Appendix 4)

If the Lesion Does Not Rub Away with Gauze

If the clinical diagnosis of etiology is not apparent, a clinical diagnosis of leukoplakia should be made and epithelial dysplasia must be ruled out by biopsy/histopathology. Differential diagnosis includes keratosis (reactive or hereditary), immune-mediated conditions such as non-erosive lichen planus or a lichenoid reaction, an infectious etiology (e.g., hyperplastic candidosis or a human papillomavirus lesion), or more rarely autoimmune diseases such as systemic lupus erythematosus.

If the Lesion Is Present Since Childhood and Bilateral/Symmetrical White-Only Changes

Consider hereditary keratosis (e.g., white sponge nevus).

- Symptoms: Asymptomatic
- History: Present since childhood, other family members affected

- Signs: Often generalized, may involve extra-oral mucosal sites
- Diagnostics: Biopsy if history and examination findings are unclear
- Treatment: Reassurance to the patient of the benign nature of the condition

If on Buccal Mucosa at the Level of the Occlusal Plane and/or on the Lateral Tongue, and White Only

Consider a reactive, traumatic frictional keratosis:

- Symptoms: Asymptomatic, occasionally a mild discomfort in the presence of epithelial breakdown
- History: Cheek/tongue/lip chewing (possibly associated with anxiety)
- Signs: Often as a linea alba, but can affect any area that can be traumatized
- Diagnostics: Biopsy if etiology is unclear
- Treatment: Reassurance; consider acrylic appliance in severe cases where ulceration occurs; consider psychological source and referral

If the Patient Uses Tobacco Products and White Only

Consider smoker's keratosis/nicotinic stomatitis or smokeless tobacco keratosis:

- Symptoms: Asymptomatic
- History: Smoker (cigarettes, cigars, pipes, etc.), smokeless tobacco (chewing, snuff, etc.)
- Signs: Prominent minor salivary gland duct openings on palate (nicotinic stomatitis); associated tobacco malodor and tooth staining; corrugated mucosa and gingival recession associated with site(s) of tobacco placement (smokeless tobacco).
- Diagnostics: Biopsy only, if features are atypical and suspicious for dysplasia/malignancy.
- Treatment: Cease tobacco use.

If the Lesion is Bilaterally on the Lateral Border of the Tongue and White Only

Consider oral hairy leukoplakia:

- Symptoms: Asymptomatic
- History: Known HIV or high-risk activity, or other underlying cause of immunosuppression
- Signs: Vertical corrugations, other oral manifestations of HIV disease may also be present (e.g., pseudomembranous or erythematous candidosis), most commonly lateral border of tongue
- Diagnostics: Generally clinical diagnosis is sufficient; biopsy plus *in situ* hybridization for Epstein-Barr virus; mucosal smear to confirm EBV; exclude candida

- **Treatment:** If unknown HIV infection, consider referral for testing (Appendix 18). If patient concerned as to appearance, consider antivirals (acyclovir or valacyclovir to manage EBV) (Appendix 12, Table A12-4, and Appendix 18).

If the Lesion Has Fingerlike or Papillary Projections

Consider benign human papillomavirus infection (e.g., viral squamous papilloma, verruca vulgaris, condyloma acuminatum, HIV-associated florid papillomatosis, focal epithelial hyperplasia):

- **Symptoms:** Asymptomatic
- **History:** Possible history of sexually transmitted disease (genital/anal warts), HIV, or high-risk activity
- **Signs:** May be solitary vs. multiple vs. generalized; exophytic (pedunculated or sessile), can involve lips, often has surface changes (although can be flat)
- **Diagnostics:** Biopsy
- **Treatment:** If generalized and unknown HIV infection, consider referral for testing. Excision, but if widespread and recurrent, consider topical or systemic agents (e.g., interferon)

If Lesions Show Bilateral Symmetrical and Classical Reticular Striae

Consider lichen planus, lichenoid mucositis:

- **Symptoms:** Depending on presence/degree of erosions or ulceration, range from asymptomatic to sensation of roughness to tongue, to sensitivity, to acidic/spicy foods, to significant pain
- **History:** Medications, foods/beverages, oral hygiene products, or other allergens can cause lichenoid mucositis; temporal association with the start of the lesions and the commencement of a specific medication (although not always), e.g., nonsteroidal anti-inflammatories, antihypertensives, and oral hypoglycemic agents
- **Clinical signs:** Oral lesions may be white only, red with peripheral white changes, or ulcerated with periphery of red and white; may be skin lesions and/or possibly symptomatic genital lesions
- **Diagnostics:** Biopsy (of white areas); possible patch testing for allergens; direct immunofluorescence rarely useful
- **Treatment:** Topical or systemic corticosteroids, or calcineurin inhibitors for symptomatic or ulcerative disease (Appendix 12, Table A12-4); discontinuation of possible causative agents may help

If the Lesion is Unilateral or Asymmetric and Has Reticular Striae

Consider lichenoid reaction:

- **Symptoms:** Range from asymptomatic to sensitivity to spicy/acidic foods/beverages

- History: Previous dental treatment (e.g., amalgam)
- Signs: Lesions in direct contact with amalgam restorations (so-called contact or “kissing lesions”)
- Diagnostics: Biopsy and/or consider patch test for amalgam and planned replacement materials
- Treatment: Consider replacing amalgams with an alternative restorative material

If the Lesion Has Atypical Pattern or Distribution of Striae

Consider lupus erythematosus (LE), graft-versus-host disease (GVHD), or chronic ulcerative stomatitis:

- Symptoms: Sensitivity to spicy/acidic foods/beverages
- History: Long-standing presentation with or without systemic disease. For GVHD, history of allogeneic transplant
- Signs: In LE (discoid vs. systemic), oral signs usually erosive or ulcerative with annular white striae, particularly on the palate. Systemic LE (SLE) and GVHD may see extra-oral manifestations (skin and other organ involvement)
- Tests: Biopsy for both histology and direct immunofluorescence; indirect immunofluorescence or serology, especially screening for systemic lupus erythematosus (ds-DNA, and Sm antibodies) or chronic ulcerative stomatitis (ANA+ in IIF)
- Treatment of oral manifestation: Topical or systemic corticosteroids or other immunomodulatory agents (Appendix 12, Table A12-4)

If There Is No Apparent Cause

Consider leukoplakia a clinical diagnosis warranting biopsy to rule out a potentially malignant oral lesion (i.e., epithelial dysplasia or squamous cell carcinoma):

- Symptoms: Generally asymptomatic. Squamous cell carcinoma can be symptomatic. High-grade dysplasia and squamous cell carcinoma (advanced but sometimes early carcinomas too) can be painful
- History: May have no risk factor history vs. any type of tobacco with or without alcohol use. Poor diet; possible immunosuppression
- Signs: White only (homogeneous vs. non-homogeneous, speckled, granular, verrucous), mixed red/white (erythroleukoplakia), or mixed red/white/ulcerated. Latter mixed signs are more ominous
- Diagnostics: Incisional biopsy of most “suspicious” site(s) (red, ulcerated, or areas with positive toluidine blue staining)
- Treatment: If benign (epithelial hyperkeratosis/hyperplasia): observation; if hyperplastic candidiasis, consider underlying cause and prescribe antifungal agents (Appendix 12, Table A12-4). If dysplasia, carcinoma-in-situ: referral to appropriate clinician for management. Excision should only be performed by a surgeon who can provide definitive management. All patients with dysplasia/carcinoma must receive risk factor counseling and close surveillance

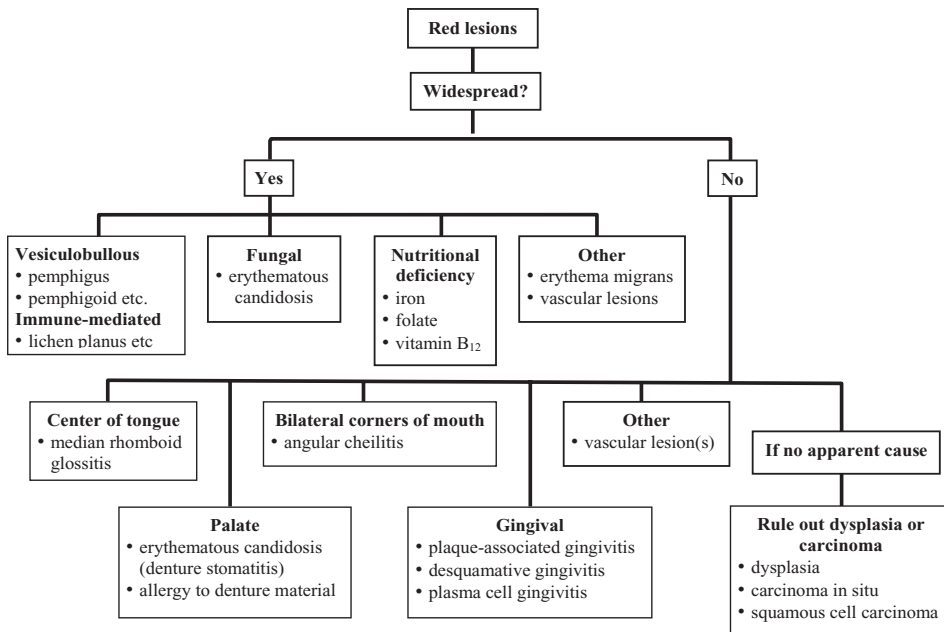


Figure 3.2. Red lesions or lesions with a predominant red component.

Red Lesions

Red or erythematous lesions can present with or without other mucosal changes. They are associated with increased inflammation (i.e., rubor) as the result of thin/atrophic/eroded mucosa, or because of an increase in vascularization; may be solitary, multiple, or widespread (i.e., on multiple bilateral mucosal sites); may be restricted to certain anatomic sites, e.g., the gingivae (Figure 3.2).

If Redness Is Widespread and Associated with Inflammatory Diseases with White and/or Ulcerative Changes

Establish the diagnosis (e.g., lesions with striae [see section on white lesions] or vesiculobullous diseases [see section on ulcerative lesions]. Note: rarely would these diagnoses show red-only changes.

If Red-Only Lesions Are Patchy and Widespread

Consider erythematous candidosis:

- Symptoms: Generally burning; may be associated with xerostomia
- History: Recent antibiotic therapy, immunosuppression, anemia, xerogenic medications (see other potential risk factors under “Pseudomembranous Candidosis” above)

- Signs: Red mucosa with possible subtle white changes that can be wiped away
- Diagnostics: Mucosal smear (KOH float or staining with PAS)
- Treatment: Antifungals (e.g., topical agents) (Appendix 12, Table A12-4).

If Redness Is Associated with Clinically Atrophic Mucosa (Especially the Tongue)

Consider nutritional deficiencies:

- Symptoms: Burning, sensitivity to hot and/or spicy foods; possible dysphagia/odynophagia; extra-oral possible fatigue, possible numbness of extremities or other neurological symptoms (vitamin B₁₂ deficiency)
- History: Poor diet, gastrointestinal disease/gastrectomy, loss of blood (e.g., gastrointestinal or menstrual bleeding), alcoholism
- Clinical signs: Patchy erythema, associated angular cheilitis, atrophic tongue (loss of papillae), possible oral ulceration
- Diagnostics: Complete blood count (check hemoglobin and MCV); serum ferritin, folate, and vitamin B₁₂ levels
- Treatment: Replacement therapy; investigation and correction of underlying systemic causes of deficiency state

If Redness Is Found in the Center of the Tongue Dorsum

Consider median rhomboid glossitis:

- Symptoms: Asymptomatic, sometimes burning
- History: Corticosteroid inhaler, smoking, HIV infection (or risk factors for HIV infection)
- Signs: Smooth, erythematous patch in the center of the tongue; check for erythematous “kissing” contact lesion on the palate; longstanding lesions may have overlay of white changes that cannot be wiped away
- Diagnostics: Mucosal smear if etiology in doubt
- Treatment: Identify local/systemic factors (e.g., HIV infection); Consider antifungals (Appendix 12, Table A12-4), smoking cessation

If Redness Is Restricted to the Palate and the Patient Wears a Denture

Consider denture-related stomatitis (a form of erythematous candidosis); allergy to denture material (rare):

- Symptoms: Metallic taste, possible burning
- History: Denture wearer; poorly fitting denture, poor denture hygiene (sleeping with denture in place), recent denture delivery (for allergy)

- Clinical signs: Redness maps to denture-bearing tissues (typically on palate); severe changes may show papillary surface
- Diagnostics: Mucosal smear if etiology in doubt
- Treatment: Improve denture hygiene, soaking the denture in antifungal solution, topical antifungal therapy (Appendix 12, Table A12-4)

If Redness Is Bilateral at the Corners of the Mouth (Commissures)

Consider angular cheilitis:

- Symptoms: Soreness, burning, cracking
- History: Any medical disorder predisposing patient to oral candidosis (e.g., hematinic deficiency, diabetes mellitus, HIV-infection or other immunosuppressed states); denture use; xerostomia
- Signs: If the patient uses dentures, possible reduced vertical dimension or poor denture hygiene (i.e., denture stomatitis); if no denture, possible signs of salivary hypofunction; possible fatigue (anemia) or other signs associated with possible medical disorders
- Diagnostics: Generally a clinical diagnosis. If uncertain, consider mucosal smear for candida
- Treatment: Topical antifungals (Appendix 12, Table A12-4). If unresponsive, consider combination topical antifungal/corticosteroid, or culture to rule out bacterial infection (e.g., Staphylococcal or Streptococcal). If intraoral candidosis, must treat external and internal components. If loss of vertical dimension, consider denture fabrication. If persists despite treatment, consider microbial resistance, systemic conditions, or immunocompromised states

If There Is Gingival Redness with Desquamation

Consider desquamative gingivitis (e.g., vesiculobullous diseases or lichen planus. See “Ulcerative lesions” below)

- Symptoms: Gums are red, bleed easily, or there is soreness when brushing, blisters on gums
- History: Skin diseases (e.g., lichen planus, psoriasis, vesiculobullous disorder), recent medication
- Signs: Positive Nikolsky sign (i.e., epithelium peels away when rubbed); other oral mucosal lesions and/or associated skin lesions. White reticular changes associated with redness suggest lichen planus/lichenoid mucositis reaction
- Diagnostics: If clinical doubt exists and oral hygiene is poor improve oral hygiene and re-evaluate; if suspicious of vesiculobullous disease, biopsy (away from the gingival margin), and submit for routine histology and direct immunofluorescence
- Treatment: Management depends upon diagnosis—topical corticosteroids or calcineurin inhibitors; systemic agents (Appendix 12, Table A12-4)

If There Is Gingival Redness without Desquamation, Not Plaque-Associated

Consider plasma cell gingivitis:

- Symptoms: Soreness; sensitivity to toothpastes, foods, etc.
- History: Rapid onset associated with change of habit (e.g., new toothpaste)
- Signs: Gingival changes predominate but may extend onto other surfaces
- Diagnostics: Patch test for potential allergens
- Treatment: Exclude allergen (e.g., tartar control toothpaste), possible topical corticosteroid therapy (Appendix 12, Table A12-4)

If Redness Is Not the Result of Inflammation

Consider a vascular lesion (widespread vs. localized):

- Symptoms: Generally asymptomatic
- History: Longstanding vs. recent onset (often following trauma). May be associated with certain syndromes (e.g., Sturge-Weber or Osler-Rendu-Weber)
- Signs: Flat red lesion(s) vs. exophytic red-blue lesions; localized vs. widespread and extra-oral
- Diagnosis: Diascopy (blanching upon pressure), imaging (for larger lesions), biopsy
- Treatment: No treatment for small nonprogressing lesions; surgical vs. embolization for large and progressing lesions

If No Apparent Cause for Redness

Consider erythroplakia or erythroleukoplakia (a clinical diagnosis warranting biopsy to rule out potentially malignant oral lesions [i.e., dysplasia or squamous cell carcinoma]):

- Symptoms: Generally asymptomatic but may be symptomatic
- History: May have no risk factor history vs. any type of tobacco with or without alcohol use; poor diet; possible immunosuppression
- Signs: Red or red/white (erythroleukoplakia), or red/white/ulcerated; possible friability of lesion (i.e., bleeds easily)
- Diagnostics: Incisional biopsy of most “suspicious” site(s) (red, ulcerated, or areas with positive toluidine blue staining)
- Treatment: If dysplasia, carcinoma-*in-situ* refer to appropriate clinician for management. Excision should only be performed by a surgeon who can provide definitive treatment. All patients with dysplasia/carcinoma must receive risk factor counseling and close surveillance

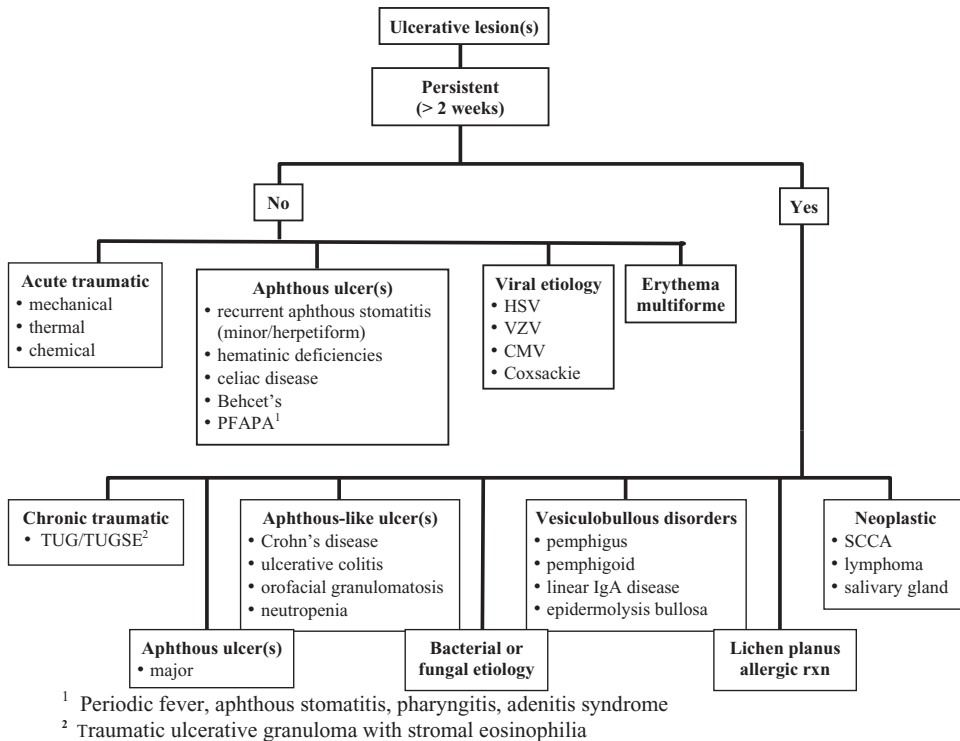


Figure 3.3. Ulcerative lesions.

Ulcerative Lesions

Ulcers are defined as lesions devoid of epithelium. They can be short-lived vs. chronic (longer than two weeks); single occurrence vs. recurrent (i.e., episodes separated by ulcer-free intervals); superficial or deep; solitary or multiple or widespread (i.e., on multiple bilateral sites); restricted to certain anatomic sites, e.g., non-keratinized mucosa (e.g., recurrent aphthous stomatitis) vs. keratinized mucosa (e.g., gingivae or palate in the case of recurrent intra-oral herpes). May be an effect of end-organ disease or multi-organ disease processes. There is therefore a large range of potential lesions in the differential diagnosis (Figure 3.3).

If Ulcer Has Possible Traumatic Cause

Consider traumatic ulcer(s):

- Symptoms: Pain, sensitivity to foods/beverages
- History: Onset associated with a traumatic event (e.g., biting tongue, new denture); most heal within two weeks unless source of trauma not removed

- Signs: Generally single ulcer; involves sites most commonly traumatized (e.g., lateral borders of the tongue, buccal vestibule); chronic traumatic ulcer may have keratotic border (typical on tongue)
- Diagnostics: None unless ulcer persists. In cases of traumatic ulcerative granulomas (TUG) or traumatic ulcerative granuloma with stromal eosinophilia (TUGSE) a biopsy may be necessary (Figure 3.3).
- Treatment: Remove cause and follow up in two to three weeks for healing. Note: If patient has a dry mouth, consider ways to boost oral lubrication (see section on dry mouth)

If Recurrent Ulcer Involves Non-Keratinized Mucosa

Consider recurrent aphthous stomatitis (RAS) (minor vs. herpetiform vs. major vs. complex) [may be associated with underlying systemic diseases], see Figure 3.3):

- Symptoms: Pain (moderate to severe), difficulty eating/swallowing, occasional malaise and fever (if large ulcer(s)). Positive review of systems if underlying systemic disease (e.g., fatigue if anemia; gastrointestinal symptoms if inflammatory bowel disease (IBD) [e.g., Crohn's disease, etc.]
- History: Recurrent (either long-term history vs. recent onset of recurrences); onset can be associated with trauma; frequent vs. rare recurrences; limited duration of about seven to 10 days (minor or herpetiform) or greater than one month (major); often no medical history but possible (e.g., HIV infection, anemias, cyclic neutropenia, gastrointestinal disease)
- Clinical signs: Aphthae involve non-keratinized moveable mucosa. Minor aphthae are round or oval, less than 10 mm in diameter, and solitary or multiple. If there are multiple, small (less than 5 mm), round, and often coalescing ulcers, consider herpetiform aphthae. If the ulcers are solitary or multiple, but irregular, large (greater than 10 mm) and sometimes deep, consider major aphthae. All have tan-colored necrotic centers with intense erythematous halo
- Diagnostics: None required if there is a history of infrequent idiopathic RAS (long-term history). If there is a history of frequent, worsening, or major ulcerations consider baseline complete blood count, serum ferritin, folate, and vitamin B₁₂ levels to rule out the unusual case of hematinic deficiency, or referral for work-up of other systemic diseases associated with RAS
- Treatment: Palliative if minor RAS with infrequent recurrence (topical anesthetics vs. mucosal barriers vs. topical anti-inflammatory agents); anti-inflammatory vs. immunomodulatory agents for frequent recurrences or major RAS (Appendix 12, Table A12-4). If underlying systemic cause refer to appropriate clinician for management

If Non-Persistent Ulcers Involve Keratinized Mucosa

Consider recurrent intra-oral herpes simplex infection (HSV). Differential includes shingles (varicella zoster virus infection [VZV]):

- Symptoms: Mild discomfort
- History: Recent onset, duration seven to ten days
- Signs: Unilateral; involving hard palate or gingivae; multiple ulcers, punctate and coalescing; if following distribution of trigeminal nerve branch with possible skin involvement consider shingles (i.e., secondary VZV infection)
- Diagnostics: Generally none; if unsure consider smear, viral culture (if early disease)
- Treatment: Symptomatic; antiviral agents if severe, frequent outbreaks, or immunocompromised patient (Appendix 12, Table A12-4)

If Ulcers Are Involved with Concomitant Gastrointestinal Symptoms and/or Lip Swelling

Consider inflammatory bowel disease (ulcerative colitis and Crohn's). Differential includes celiac disease or orofacial granulomatosis:

- Symptoms: Oral discomfort; gastrointestinal (GI) symptoms (i.e., possible diarrhea, pain, bleeding)
- History: Recurrent, often persistent ulcers until treated
- Signs: Variable, any one or combination of fluctuating lip swelling (possible in Crohn's and orofacial granulomatosis), aphthous-like ulcerations, cobblestone mucosa, deep linear ulcerations, mucogingivitis, granulomatous angular cheilitis, vertical lip fissures, mucosal tags, pyostomatitis vegetans, concomitant pale mucosa, glossitis (from vitamin deficiency)
- Diagnostics: Biopsy (to look for granulomatous disease); endoscopic examination of GI tract (for Crohn's disease); patch testing to a range of dietary allergens (e.g., benzoic acid or cinnamaldehyde) for orofacial granulomatosis
- Treatment for oral manifestations: Referral to gastroenterology; control of underlying disease with immunosuppressants if appropriate (Appendix 12, Table A12-4)

If Recurrent Non-Persistent Widespread Ulcers and/or Skin Target Lesions

Consider erythema multiforme:

- Symptoms: Oral discomfort
- History: Recurrent stomatitis lasting two weeks
- Clinical signs: Bloody crusting of lips, possible target lesions, especially on hands

If Persistent Ulcers Associated with Reticular Striae

Consider ulcerative lichen planus or lichenoid reaction/mucositis (see section on white lesions)

If Persistent Widespread Ulcers Not Associated with Reticular Striae

Consider autoimmune vesiculobullous disorders:

- Symptoms: Oral discomfort, difficulty eating
- History: Sudden onset; possible history of autoimmune disease; new medication
- Signs: Variable: bullae that rupture to form ulcers; may involve any mucosal site; possible skin lesions (bullae). Note: Mucosal ulcers may precede skin involvement
- Diagnostics: Biopsy for conventional histopathology and/or direct immunofluorescence; blood draw for indirect immunofluorescence or specific auto-antibodies (e.g., desmoglein 3 for pemphigus)
- Treatment: See the specific disorders, below.

Pemphigus Vulgaris

- Diagnostics: Direct or indirect immunofluorescence shows intercellular autoantibody/complement distribution (IgG/IgM and C3), positive desmoglein 3 (mucosal involvement) and/or 1 (skin involvement)
- Treatment: Systemic corticosteroids with or without steroid-sparing agents (azathioprine vs. mycophenolate mofetil) (Appendix 12, Table A12-4)

Pemphigoid (Mucous Membrane and Bullous)

- Diagnostics: Direct immunofluorescence shows autoantibody and complement distribution at basement membrane zone (IgG/IgM and C3). Referral to ophthalmologist due to potential for eye involvement (symblepharon)
- Treatment: None if mild; topical agents for mild to moderate disease; systemic agents (corticosteroids, dapsone, and other immunosuppressant agents) (Appendix 12, Table A12-4)

Linear IgA Disease

- Diagnostics: Direct immunofluorescence shows autoantibody distribution at basement membrane zone (IgA)
- Treatment: Topical or systemic agents (Appendix 12, Table A12-4)

Epidermolysis Bullosa

- Diagnostics: Direct immunofluorescence shows autoantibody and complement distribution at basement membrane zone (IgG/IgM and C3) (antibodies to collagen); genetic testing
- Treatment or oral manifestations: Depends on severity—topical vs. systemic agents (Appendix 12, Table A12-4)

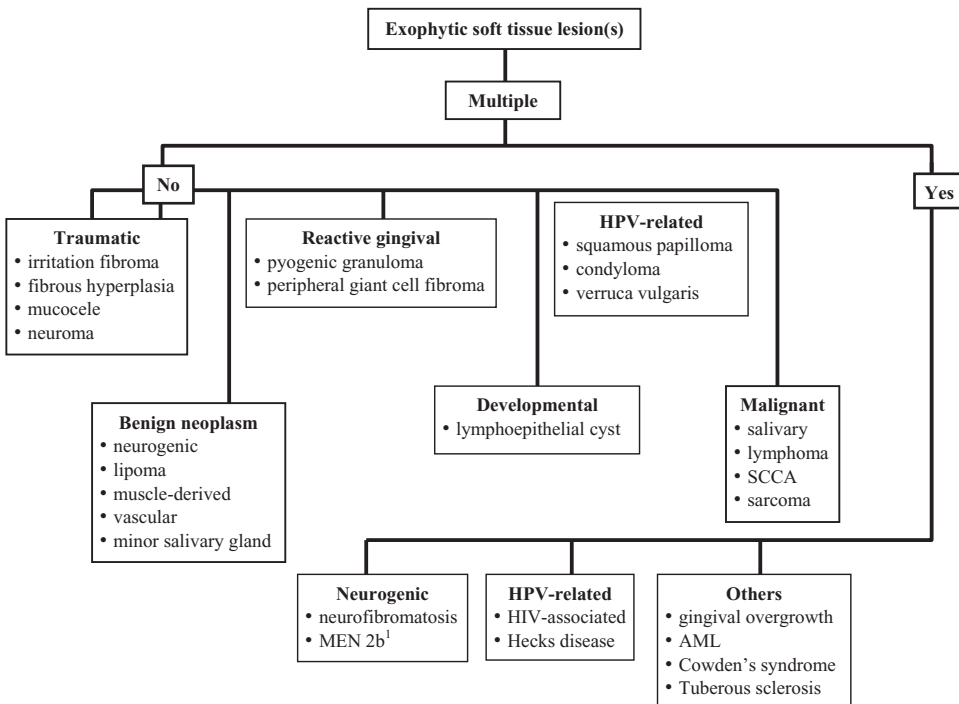
If Solitary Ulcer with No Obvious Cause and Persistent (Greater Than Two Weeks)

Rule out squamous cell carcinoma or other malignancy (e.g., lymphoma, salivary gland malignancy). Other entities in differential diagnosis include traumatic ulcerative granuloma (TUG) (with or without stromal eosinophilia; TUGSE), major aphthous ulcer, necrotizing sialometaplasia, neutropenic ulcer, bacterial infection (e.g., tuberculosis or syphilis), deep fungal infection (histoplasmosis, aspergillosis, mucormycosis, etc.), or viral infection (e.g., cytomegalovirus):

- Symptoms: Pain
- History: Risk factor history for carcinoma (i.e., tobacco with or without alcohol; areca nut, etc.)
- Signs: Rolled edge, induration, possible regional lymphadenopathy
- Diagnostics: Incisional biopsy after two weeks if not resolving from local measures
- Treatment: If biopsy is positive for carcinoma, refer to appropriate surgeon

Exophytic Lesions

Exophytic lesions may be epithelial and/or submucosal and the result of a traumatic, reactive, or neoplastic process (Figure 3.4). Such lesions protrude above the



¹ MEN 2b Multiple endocrine neoplasia 2b

Figure 3.4. Exophytic lesions.

surrounding mucosa and may be pedunculated (on a stalk) or sessile (a broad base). Small exophytic lesions (less than 5 mm in diameter) are known as papules, and those greater than 5 mm in diameter are known as nodules. Pay close attention to visual clues such as surface texture, color, and characteristics upon palpation (i.e., soft vs. firm vs. induration).

If Solitary and in a Traumatic Zone (e.g., Buccal Mucosa, Tongue)

Consider irritation fibroma. Differential diagnosis includes mucocele, neurogenic lesion:

- Symptoms: Asymptomatic
- History: History of repeated trauma (biting)
- Signs: Papule to nodule; sessile; usually normal overlying epithelium; firm to palpation
- Diagnostics: None
- Treatment: Surgical excision and submission for histopathology to confirm diagnosis

If Solitary and on Lower Labial Mucosa:

Consider mucocele (note mucocèles can occur in any site where there are minor glands, but most commonly in lower lip):

- Symptoms: Possible discomfort
- History: History of trauma (biting); often will fluctuate in size
- Signs: Papule to nodule; sessile; usually normal overlying epithelium; may have a bluish appearance
- Diagnostics: None
- Treatment: Surgical excision and submission for histopathology to confirm diagnosis

If Associated with an Ill-Fitting Denture

Consider fibrous hyperplasia (epulis fissuratum):

- Symptoms: Often asymptomatic
- History: Old and loose denture
- Signs: Exuberant tissue associated with denture flange
- Diagnostics: None
- Treatment: Surgical excision and submission for histopathology to confirm diagnosis; reline/refabrication of denture

If Solitary Lesion on Gingivae

Consider reactive gingival lesion (pyogenic granuloma, peripheral giant cell granuloma, peripheral ossifying fibroma):

- Symptoms: Often asymptomatic
- History: Pyogenic granuloma may have possible hormonal association (pregnancy, menarche, menstruation)
- Signs: Often involve interdental papilla; may be red and bleed easily (pyogenic granuloma); often pedunculated; possible periodontal issue (pyogenic granuloma)
- Diagnostics: Periapical radiograph
- Treatment: Surgical excision and submission for histopathology to confirm diagnosis; scaling and root planing

If Lesions Have Fingerlike or Papillary Projections

Consider human papilloma virus lesion (viral squamous papilloma, verruca vulgaris, condyloma acuminatum): See section on white lesions

If Solitary Lesion Is Orange/Yellow

Consider a lipoma: Differential diagnosis includes lymphoepithelial cyst, lymphangioma, neurogenic tumor (e.g., neurofibroma, neurilemoma, granular cell tumor), verruciform xanthoma, or a salivary stone:

- Symptoms: Asymptomatic
- History: none
- Signs: Submucosal nodule; can occur on any site (buccal and labial mucosa most common)
- Diagnostics: None
- Treatment: Surgical excision and submission for histopathology to confirm diagnosis

If Solitary Submucosal Lesion on Dorsum of Tongue

Consider granular cell tumor:

- Symptoms: Asymptomatic
- History: None
- Signs: Firm submucosal nodule with yellowish color; most common on tongue dorsum but can occur on any site
- Diagnostics: None
- Treatment: Surgical excision and submission for histopathology to confirm diagnosis

If Solitary Red/Blue Lesion Not Associated with Inflammation

Consider vascular lesion (hemangioma or vascular malformation): See section on red lesions

If Multiple Gingival Lesions

Consider gingival overgrowth secondary to medications: Differential diagnosis includes inflammatory gingivitis, hereditary gingivofibromatosis, acute leukemia

- Symptoms: Asymptomatic
- History: Medical condition and associated medication, e.g., epilepsy and phenytoin, organ transplant and cyclosporine A, hypertension and calcium-channel blockers (e.g., nifedipine)
- Signs: Firm, often pink-red gingival overgrowth; variable severity
- Diagnostics: None
- Treatment: Surgical excision and biopsy/submission for histopathology to confirm diagnosis; oral hygiene; possible change to different medication

If Exophytic Lesion with No Obvious Cause and Persistent (Longer Than Two Weeks)

Rule out malignancy (e.g., squamous cell carcinoma, salivary gland malignancy, sarcoma, lymphoma, plasmacytoma). Other entities in differential diagnosis include other benign neoplasms e.g., pleomorphic adenoma, muscle-derived neoplasm

- Symptoms: Possible pain
- History: Immunocompromised (e.g., HIV infection); risk factor history (i.e., tobacco with or without alcohol; areca nut, etc.)
- Signs: Possible regional lymphadenopathy; possible ulceration
- Diagnostics: Incisional biopsy
- Treatment: If biopsy is positive for malignancy, refer to appropriate surgeon

If Multiple Exophytic Lesions Resembling Fibromas

Consider neurofibromatosis: Differential diagnosis includes Cowden's syndrome, tuberous sclerosis, multiple endocrine neoplasias (2B) (multiple mucosal neuromas)

Pigmented Lesions

Pigmented lesions are caused by extrinsic substances (e.g., amalgam tattoo) or intrinsic pigmentation caused by a proliferation of melanocytes (or nevus cells) or an increased production of melanin (e.g., melanotic macule or post inflammatory pigmentation) (Figure 3.5).

If Lesions Are Focal and Linked to Restorative History Using Amalgam

Consider amalgam tattoo: Differential diagnosis includes melanotic macule, intra-oral nevus

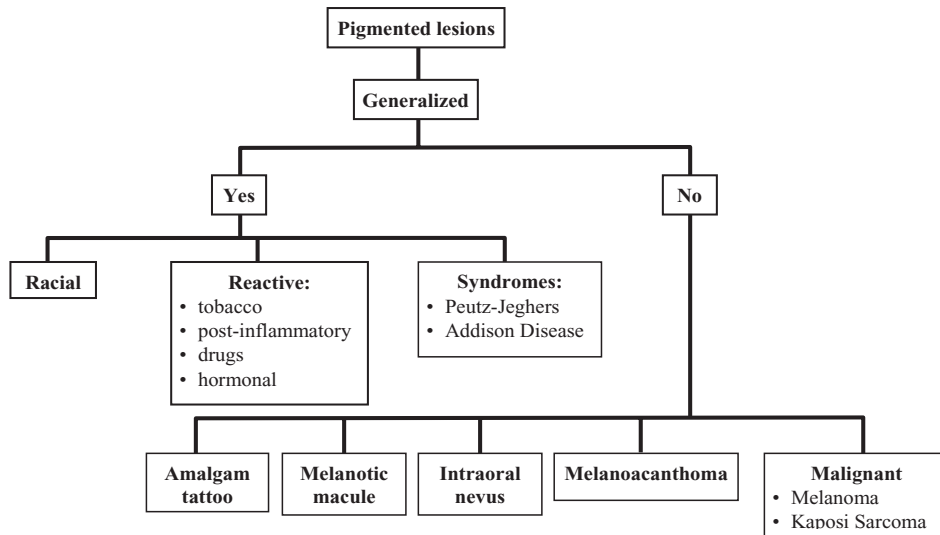


Figure 3.5. Pigmented lesions.

- Symptoms: Asymptomatic
- History: Lesion long-standing and tends not to change in appearance over time; history of restorative procedure or extraction
- Signs: Bluish gray macule(s) on tissue in proximity to dental trauma. Note: Can see tattoos in floor of mouth secondary to mucosal trauma from suction tip
- Diagnostics: Radio-opaque pinpoint particles can sometimes be appreciated on radiographs; if no clear-cut etiology, consider biopsy
- Treatment: None

If Lesions Are Focal and Recent Onset

Rule out malignancy (i.e., melanoma or early Kaposi's sarcoma (KS): Differential diagnosis includes melanoacanthoma, melanotic macule, intra-oral nevus

- Symptoms: Asymptomatic
- History: Recent onset; no apparent etiology (melanoma); history of HIV infection (KS)
- Signs: Enlarging; color usually can be blue/black, brown; heterogeneous appearance; most likely on hard palate or gingivae
- Diagnostics: If suspicious for melanoma, do not biopsy but refer directly to head and neck oncologic surgeon; refer for infectious disease HIV workup if suspicious of HIV infection/AIDS (Appendix 18)
- Treatment: By the oncology or infectious diseases services

If Homogeneous Solitary Lesion on Palate

Consider intra-oral nevus:

- Symptoms: Asymptomatic
- History: Recent onset; no apparent etiology
- Signs: Generally non-enlarging; color usually can be blue/black, brown; usually homogeneous appearance; most likely on hard palate or gingivae
- Diagnostics: Biopsy (generally excisional)
- Treatment: Excision

If Multiple Lesions with Perioral Involvement

Consider Peutz–Jeghers syndrome:

- Symptoms: Orally asymptomatic
- History: Lifelong lesions; possible history of intestinal polyps
- Signs: Multiple black macules with labial and peri-oral involvement
- Diagnostics: Gastrointestinal work-up
- Treatment: Observation; refer to physician

If Pigmentation Is Diffuse

Consider drug-induced (e.g., antibiotics, cancer chemotherapy agents, anti-malarials, oral contraceptives, etc.): Differential includes reactive pigmentation

- Symptoms: Asymptomatic
- History: Drug use (chronologic association may be spurious)
- Signs: Multiple diffuse lesions
- Diagnostics: Rarely indicated for biopsy
- Treatment: None, consider change or withdrawal of drug(s)

If Negative Drug History and Diffuse

Consider reactive pigmentation:

- Symptoms: Asymptomatic
- History: Past history of chronic inflammatory disease (e.g., oral lichen planus); smoker (smoker's melanosis); hormonal changes (i.e., pregnancy).
- Signs: Diffuse pigmentation; palatal involvement common in smoker's melanosis; buccal mucosal and lateral tongue involvement common in oral lichen planus

- Diagnostics: Biopsy
- Treatment: Stop tobacco use (smoker's melanosis)

If No Drug or Smoking History

Consider Addison disease:

- Symptoms: Non-specific, i.e., fatigue, malaise, anorexia, nausea/vomiting, abdominal pain, myalgias
- History: Possible autoimmune diseases (e.g., Type 1 diabetes, autoimmune thyroid disease) or infectious disease history (e.g., tuberculosis)
- Signs: Pigmentation of skin and mucous membranes, low blood pressure, postural hypotension
- Diagnostics: Adrenal work-up (i.e., morning serum cortisol, Synacthen test, adrenocorticotrophic hormone [ACTH] levels, adrenal auto-antibodies)
- Treatment: Glucocorticoid/mineralocorticoid replacement. Refer to endocrinologist

If No Abnormalities Detectable

Consider racial pigmentation

Pain and Altered Sensation

Orofacial pain can be acute or chronic, episodic or persistent. Odontogenic pain is the most common type encountered by oral health care providers; however, an astute clinician must consider nonodontogenic diagnoses (such as neuropathic pain or referred muscular pain) when a presumptive toothache either does not seem to have a clear etiology or does not respond to conventional treatment (Appendix 14). Altered sensations may be negative and generally equated with a reduction or loss of sensory discrimination (including specialized sensory input) (i.e., hypoesthesia or paresthesia) or positive and equated with an increase or change in usual sensation (i.e., hyperesthesia, dysesthesia, or phantom sensation). Sometimes pain and altered sensation are overlapping symptoms.

Orofacial Pain

Intra-Cranial Pain Disorders

Intra-cranial pain disorders are potentially life-threatening disorders including vascular (e.g., intra-cranial hemorrhage) and nonvascular (e.g., intra-cranial mass) disorders.

If Patient Has Pain Associated with the Following Signs and Symptoms: Systemic Symptoms (e.g., Fever Or Weight Loss); Systemic Disease (e.g., HIV, Systemic Cancer); Neurologic Signs/Symptoms (e.g., Confusion, Clumsy, Weak, Aphasic); Sudden Onset (e.g., Thunderclap Headache, Progressive, Positional); Older Age; Pattern Change from Existing Pain (i.e., Quality or Severity)

Consider intra-cranial pain disorder and refer to appropriate clinician.

Primary Headache Disorders

Primary headache disorders include migraines, tension-type headaches, and cluster headaches (and other trigeminal autonomic cephalgias such as paroxysmal hemicrania or short-lasting unilateral neuralgiform headache attacks with conjunctival injection and tearing [SUNCT]).

If Headache Is Episodic, Unilateral, Pulsatile, Moderate to Severe Pain, Aggravated by Routine Physical Activity, and Associated with Nausea/Vomiting or Photophobia/Phonophobia

Consider migraine:

- Symptoms: With aura (e.g., blurred vision, sensitivity to light/sound, nausea, fatigue, difficulty concentrating) or without aura; aura precedes unilateral pulsatile pain and associated symptoms (e.g., possible nausea, photophobia, and phonophobia); pain may last from four to 72 hours
- History: Unilateral headaches (at least five attacks)
- Signs: Vomiting, sensitivity to light/sounds
- Diagnostics: None other than successful trial with abortive agents (e.g., serotonin receptor antagonists)
- Treatment: Avoid triggers (e.g., certain foods); referral to appropriate clinician for consideration of abortive, symptomatic or prophylactic pharmacotherapies (Appendix 12, Table A12-4)

If Headache Is Episodic, Bilateral, Band-Like, Dull Ache, Mild-Moderate Pain

Consider tension-type headache:

- Symptoms: Dull ache; band-like; tightness; pressure; bilateral; non-pulsatile; pain may last from four to 72 hours
- History: Bilateral headaches; may be infrequent (less than one/month) or frequent (less than 15 days/month) or chronic; stress associated
- Signs: Possible difficulty masticating if temporalis/masseter involved
- Diagnostics: None
- Treatment: Avoid stressors; pharmacotherapies (e.g., nonsteroidal anti-inflammatory agents, muscle relaxants; Appendix 12, Table A12-4); relaxation or physical therapy; referral to appropriate clinician for chronic headaches

If Headache Is Episodic, Unilateral, Pulsatile, Severe Pain Involving the Orbital/Supraorbital/Temporal Region

Consider cluster headache. Differential diagnosis includes paroxysmal hemicrania or short-lasting unilateral neuralgiform headache attacks with conjunctival injection and tearing (SUNCT):

- Symptoms: Boring pulsatile pain; often onset during first cycle of REM sleep (awakens patient after 60 to 90 minutes); band-like; pain generally lasts from 15 minutes to three hours, depending on treatment
- History: Unilateral headaches coming in clusters (one to two clusters/year, each lasting up to three months, often at same time of year); headaches can become chronic in less than 20% of population
- Signs: Autonomic signs may include tearing, conjunctival injection, rhinorrhea or nasal congestion, sweating, miosis, ptosis, or eyelid edema
- Diagnostics: None
- Treatment: Referral to appropriate clinician for consideration of abortive (e.g., oxygen), symptomatic, or prophylactic pharmacotherapies (Appendix 12, Table A12-4)

Secondary Headache Disorders

Secondary headache disorders include temporal (giant cell) arteritis, posttraumatic headache, headaches due to infections (e.g., meningitis, otitis media), neoplasms, and medication overuse. The International Headache Society classification includes numerous other types including overlap with “intra-cranial pain disorders”

If Headache Is New, Persistent, Unilateral (or in Fewer Cases Bilateral), with Tenderness of Temporal Arterial Region in Patients Under 50 Years

Consider temporal arteritis. Differential diagnosis includes venous thrombosis, carotid artery dissection, or aneurysm

- Symptoms: Persistent moderate unilateral to bilateral headache; possible tenderness over scalp (i.e., during hair brushing or combing); possible shoulder/hip pain (polymyalgia rheumatica), pain in jaw after chewing, unocular visual change or loss (can lead to blindness)
- History: New headache in older patient population; more frequent in women
- Signs: Swollen and tender artery with reduced pulse
- Diagnostics: Elevated erythrocyte sedimentation rate(ESR); arterial biopsy showing giant cells
- Treatment: Systemic corticosteroids; urgent referral to ophthalmologist

Neuropathic Pain Disorders

Neuropathic pain is defined as pain arising from injury, disease, or dysfunction of the peripheral and/or central nervous system. Depending on the etiology it can be

episodic or constant. It may be peripherally generated or centrally mediated. Complex regional pain syndromes (reflex sympathetic dystrophy or causalgia) are exceedingly rare in the head and neck but have a severe burning component

If the Pain Is Episodic, Paroxysmal, and Excruciating, with a Trigger, and Dental Causes Have Been Excluded

Consider a trigeminal or glossopharyngeal neuralgia. Differential diagnosis includes paroxysmal vascular pains (e.g., paroxysmal hemicrania or SUNCT) or primary stabbing headache.

- Symptoms: Excruciating, unbearable pain; typically very short-lived (seconds); electric or shock-like; pain-free between episodes; unilateral, generally involving V2/V3 distribution (trigeminal); unresponsive to over-the-counter or prescription analgesics
- History: Older age; sudden onset; triggered by touching face or eating (trigeminal) vs. stimulation of pharyngeal tissues (e.g., swallowing) (glossopharyngeal); can remit and recur (and upon recurrence may move from one side to other)
- Signs: If triggered during examination clinician will see facial grimace in reaction to pain
- Diagnostics: MRI to exclude multiple sclerosis or CNS tumor (e.g., meningioma)
- Treatment: Referral to appropriate clinician for consideration of pharmacotherapies (e.g., carbamazepine) (Appendix 12, Table A12-4) vs. neurosurgical approaches

If the Pain Is Persistent and Fluctuates Over the Course of a Day, and Dental (and Other) Causes Have Been Excluded

Consider an idiopathic continuous persistent neuropathic pain (atypical facial pain, atypical odontalgia, phantom tooth pain, etc.). Differential diagnosis includes post-herpetic neuralgia, odontogenic pain, myofascial pain, certain vascular pains (e.g., temporal arteritis).

- Symptoms: Mild to moderate grade pain; unilateral; constant (although rarely wakes patient at night and can be episodic); dull and aching; may mimic toothache
- History: More common in women; more than one month duration; often following traumatic dental procedure (extraction, restorative procedure, scaling/root planing); mistaken for odontogenic pain and dental treatment unhelpful; unresponsive to over-the-counter or prescription analgesics; patient has seen multiple providers; possible underlying psychiatric history
- Signs: Allodynia (or hyperesthesia) to sensory input at site of pain; no dental cause
- Diagnostics: Topical anesthesia or local anesthesia may abolish pain (peripherally generated pain); nonresponse to local anesthesia may indicate centrally mediated pain

- Treatment: Reassurance that it is not a dental problem; topical vs. systemic pharmacotherapies (e.g., anticonvulsives (gabapentin), low-dose tricyclic antidepressants (amitriptyline), or other agents (Appendix 12, Table A12-4); possible referral to appropriate provider (e.g., psychiatrist)

If the Pain Is Persistent and Follows a Course of Herpes Zoster (Shingles)

Consider post-herpetic neuralgia:

- Symptoms: Burning; possibly with brief stabbing pains; unilateral; constant
- History: Following herpes zoster infection (severity of course may correlate with neuralgia); persisting for more than three months; more common in women
- Signs: Allodynia (or hyperesthesia) to sensory input at site of pain; possible sensory loss
- Diagnostics: None
- Treatment: Systemic pharmacotherapies (e.g., anticonvulsives ([gabapentin]), low-dose tricyclic antidepressants (amitriptyline), or other agents (Appendix 12, Table A12-4)

If the Main Symptom Is a Constant Oral Burning Sensation and Other Causes Have Been Excluded

Consider a burning neuropathy (stomatodynia, glossodynia, burning mouth syndrome). Differential diagnosis includes mucosal inflammatory conditions (candidosis), geographic tongue, oral lichen planus, allergic reactions, nutritional deficiencies (see section on “altered mucosa”); uncontrolled diabetes, hypothyroidism, or psychiatric illness (depression or anxiety) or habits (e.g., tongue thrusting)

- Symptoms: Burning; restricted to tongue (or other sites) vs. widespread oral sites; bilateral; constant (although rarely wakes patient at night and can be episodic); possible taste change
- History: More common in post-menopausal women; longer than one month duration; sudden onset; intensified by certain foods (spicy, acidic); unresponsive to over-the-counter or prescription analgesics; patient has seen multiple providers; often cancerphobic; possible psychiatric history
- Signs: Examination often within normal limits
- Diagnostics: Topical anesthesia may abolish pain (peripherally generated pain); nonresponse or hyperresponsive following topical anesthesia may indicate centrally mediated pain; rule out other possible causes (e.g., diabetes [blood glucose vs. hemoglobin A1C]), hypothyroidism [TSH], anemia [CBC], nutritional deficiencies, psychiatric illness)
- Treatment: Reassurance that it is not a malignancy; topical vs. systemic pharmacotherapies (e.g., clonazepam), low-dose tricyclic antidepressants (amitriptyline), or other agents (Appendix 12, Table A12-4); possible psychiatric referral

Intra-Oral Pain Disorders

Intra-oral pain disorders involve odontogenic pain (i.e., involving teeth or supporting structures of teeth; see Chapter 5) and pain from intra-oral non-odontogenic sources such as the maxillary sinus, mucosal sites (e.g., ulcerative mucosal disorders) or submucosal sites (e.g., salivary gland infections), or bone (e.g., fracture).

If the Pain Appears Odontogenic (Dental) in Origin

Consider the source of nociception (i.e., dental pulp vs. periodontal/periapical). Determine if this is a reversible or irreversible pulpitis (secondary to caries, cracked tooth, or other dental trauma), an acute apical periodontitis/abscess, or a periodontal abscess/pericoronitis. Sequelae include fascial space infections. Differential diagnosis includes acute sinus infection, idiopathic continuous persistent neuropathic pain (e.g., atypical odontalgia), referred myofascial pain, or even vascular pain.

- Symptoms: Range from fleeting pain associated with stimuli (e.g., cold, sweet) in the case of reversible pulpitis; lingering pain of variable severity (can be excruciating), precipitated by stimuli (e.g., heat, biting) or that is spontaneous in the cases of irreversible pulpitis or an acute apical periodontitis; inability to occlude or chew; somewhat responsive to analgesics; swelling, malaise, and fever may be associated with fascial space infections
- History: Poor oral hygiene; irregular dental visits; dental caries; recent dental trauma
- Signs: Elevated temperature, look for extra-oral regional swelling and/or tender lymphadenopathy; intra-orally look for caries, hairline crack on clinical crown, abnormal pocket depths, mobility, percussion tenderness, palpation tenderness and/or fluctuance in periapical areas, or fremitus
- Diagnostics: Radiography, thermal tests (cold, hot), vitality testing, exploration, percussion, mobility, biting
- Treatment: Restorative, endodontic, surgical

If the Pain Is Associated with Percussion of Maxillary Posterior Teeth and Dental Causes Have Been Excluded

Consider maxillary sinus infection. Differential includes antral neoplasm.

- Symptoms: Maxillary posterior tooth pain; difficult to localize; pain upon biting
- History: Recent onset of tooth pain; history of sinus infections; possible upper respiratory infection (URI) in past two to three months
- Signs: Pain on percussion/palpation of maxillary posterior teeth (i.e., those with apices in close proximity to sinus, usually premolars and first molar); vitality/thermal testing of teeth normal or heightened response to cold; possible nasal congestion/blockage during inhalation
- Diagnostics: Radiographs—panoramic, Water's/CT if indicated
- Treatment: May represent transient (one to three days) of maxillary sinus membrane inflammation following URI and require no intervention. Referral to appropriate clinician. Might require decongestant/antimicrobial therapy if

infectious etiology (Appendix 12, Table A12-4). Surgical management indicated for antral neoplasms

If the Pain Is Unilateral, Constant, and Localized to Major Salivary Glands

Consider salivary gland infection secondary to obstructions from salivary stones, Sjögren's syndrome, or neoplasms (Appendix 6, Table A6-5). Differential diagnosis includes mucosal diseases (see section on altered mucosa) or referred muscular pain.

- Symptoms: Unilateral pain in site of major salivary gland (parotid, submandibular); possible malaise and/or fever
- History: Recent onset; possible history of salivary gland obstruction; possible history of salivary hypofunction (i.e., Sjögren's syndrome)
- Signs: Swelling of salivary gland with possible purulent exudate expressed from salivary gland duct opening (Stensen's vs. Wharton's); swelling and inflammation of the eardrum; possible tender lymphadenopathy
- Diagnostics: Possible sialography or other imaging modality (to find underlying reason for infection) and possible culture/sensitivity testing
- Treatment: referral to appropriate clinician, may require antimicrobial therapy if infectious etiology

If Pain Is Left-Sided and Precipitated by Exertion:

Consider cardiac pain (e.g., angina pectoris/acute myocardial infarction)

- Symptoms: Exertion-induced jaw pain, usually mandibular left
- History: Risk factors for cardiac disease
- Signs: None
- Diagnostics: Cardiac function tests
- Treatment: Management of cardiac ischemia, referral to physician

If Recurrent Episodic Jaw Pain with Concomitant Extragnathic Bone Pain

Consider sickle-cell disease:

- Symptoms: Pain can mimic toothache
- History: African descent, previous history of sickle-cell crisis triggered by hypoxic states (e.g., stress or infection)
- Signs: No signs of odontogenic infection
- Diagnostics: Serology; 90% to 95% HbS with hemoglobin electrophoresis
- Treatment: Supportive, i.e., analgesics, fluids, eliminate sources of infection. Avoid stressful procedures

Temporomandibular Disorders

The classification of temporomandibular disorders is evolving with developments in evidence-based diagnostic criteria. They are essentially split into temporomandibu-

lar joint (TMJ) disorders and disorders of the masticatory muscles. There is often overlap, and in many cases muscular pain may be secondary to other pain diagnoses.

If TMJ Pain Occurs During Jaw Movement (Usually Opening or Closing) and Is Associated with Reproducible TMJ Clicking

Consider TMJ anterior disc displacement with reduction. Differential diagnosis includes osteoarthritis.

- Symptoms: Often this condition is not associated with pain; if pain, associated with joint movement
- History: None; possible history of trauma
- Signs: No restriction of jaw movement; reproducible or reciprocal clicking; possible jaw deviation
- Diagnostics: Generally none required
- Treatment: Generally none other than reassurance

If TMJ Pain Is Associated with Limited Opening (a Closed Lock)

Consider TMJ anterior disc displacement without reduction (generally unilateral). Differential diagnosis for acute condition includes acute TMJ synovitis/capsulitis and/or acute myospasm. Chronic condition includes osteoarthritis (or other arthritides), or fibrotic ankylosis

- Symptoms: Acute condition often associated with pain; limitation in jaw opening/function
- History: Episodic locking followed by sudden onset of limited jaw opening
- Signs: Restriction of jaw movement (less than 35mm opening) with limited contra-lateral laterotrusion; ipsilateral jaw deviation; over time opening improves [with joint remodeling]
- Diagnostics: Imaging optional
- Treatment: Reassurance; most respond to conservative treatment, one or more of the following: education, self-management, physical therapy, pharmacotherapies, occlusal splints, possible surgery in selected patients

If TMJ Pain Is Not Associated with Clicking/Locking

Consider synovitis/capsulitis (arthralgia): Differential diagnosis includes osteoarthritis, polyarthritides

- Symptoms: TMJ asymptomatic at rest; acute pain and possible limitation during jaw opening/function; possible change in occlusion (if sufficient effusion/swelling)
- History: Likely trauma
- Signs: Pain during palpation of TMJ or during joint loading
- Diagnostics: Imaging optional
- Treatment: Reassurance; most respond to conservative treatment

If TMJ Pain Is Associated with Bony Changes

Consider degenerative joint disease (primary or secondary osteoarthritis, or polyarthritides):

- Symptoms: Chronic pain and possible limitation during jaw opening/function
- History: No apparent etiology (primary osteoarthritis); past history of trauma or infection (secondary osteoarthritis); polyarthritides with other joint involvement (e.g., rheumatoid arthritis and others)
- Signs: Pain during palpation of TMJ; possible crepitus
- Diagnostics: Bone imaging reveals structural bone changes/narrowing of joint space; possible serologic studies for an arthritide
- Treatment: Depends on etiology/severity; ranges from conservative treatment to systemic immunosuppressant therapies to surgical management in cases with severe limitation of function or ankylosis

If Pain Is in Muscles of Mastication without Trigger Points

Consider local myalgia. Differential diagnosis includes myofascial pain, myositis, and fibromyalgia:

- Symptoms: Minimal pain at rest; regional dull ache during function of involved muscles; possible muscle stiffness (particularly in morning if nocturnal grinding), weakness, or fatigue; and possible limitation during jaw opening/function
- History: Possible bruxism/grinding; muscle over-use
- Signs: Pain on palpation of involved muscles without trigger-points/referral; if limited opening, passive exercises will allow increased opening
- Diagnostics: None
- Treatment: Conservative treatment, one or more of the following: education, self-management, physical therapy, pharmacotherapies (e.g., nonsteroidal anti-inflammatory agents) (Appendix 12, Table A12-4)

If Pain Is in Muscles of Mastication with Trigger Points and/or Referred Pain

Consider myofascial pain. Differential diagnosis includes myofascial pain, myositis, and fibromyalgia:

- Symptoms: Regional dull ache at rest and during function of involved muscles; likely muscle stiffness weakness, or fatigue; likely limitation during jaw opening/function; occlusion may be feel high; referral patterns can be similar to a tooth-ache; possible ear symptoms, tinnitus; possible tension type headache
- History: Possible bruxism/grinding; muscle over-use; can become chronic (centrally mediated myalgia)
- Signs: Pain on palpation of involved muscles with trigger-points/referral; limited opening responds to ice (vapocoolant) or local anesthetic injection into trigger area and/or stretch (passive exercises)
- Diagnostics: None

- Treatment: Conservative treatment, one or more of the following: education, self-management, physical therapy, pharmacotherapies (e.g., muscle relaxants), trigger point injections, occlusal splint therapy

Cervical Spine Disorders

There may be overlap between of cervical spine disorders and orofacial pain, particularly headaches.

If a Patient Presents with Neck Pain, Particularly That with Whiplash-Associated Injuries (Cervical Strain), Neurological Changes Suggestive of Cervical Spine Radiculopathy (i.e., Weakness of Sensory Deficits) or Major Structural Damage (i.e., Fracture, Injury to the Spinal Cord, Infection, or Systemic Diseases (e.g., Inflammatory Arthropathies)

Consider cervical spine disorder and refer to appropriate clinician for diagnosis and treatment.

Pain from Associated Structures

Pain may arise from other structures of the head not already covered above.

If a Patient Presents with Pain Arising from the Eyes, Ears, Nasal-Paranasal Sinus Complex, or Pharynx

Refer to an appropriate clinician (e.g., ophthalmologist or otolaryngologist).

Axis II Mental Disorders

All orofacial pain patients should be assessed for axis II disorders. All can influence pain and a patient's ability to function with pain.

If a Patient Suffers from Depression, Anxiety, Substance Use Disorders, Sleep Disorders, Personality Disorders, Somatoform Disorders, and Factitious Disorders

Consider referral to psychologist or psychiatrist.

Paresthesia

Paresthesia is the complete loss in sensation due to nerve damage.

If a Patient Has Paresthesia

Consider recent trauma, osteomyelitis, malignancy, nutritional deficiency, diabetic neuropathy or multiple sclerosis:

- Symptoms: Loss of sensation along all or part of sensory nerve distribution; sudden onset (trauma) vs. worsening over time (malignancy); possible motor involvement
- History: Recent trauma, including surgery; malignancy
- Signs: Displaced bony structures and/or soft tissue damage in area of trauma; fractured or luxated teeth; signs of a malignancy
- Diagnostics: Imaging (radiographs, CT, MRI)
- Treatment: Surgical management of fractures; oncologic treatment (if malignancy); can take more than six months for nerve regeneration with potential for permanent damage; nerve grafting may be indicated

Changes in Taste and Olfaction

The etiologic disorders of change in taste sensation can include an olfactory disorder and may be associated with a local or central etiology.

Taste Disorders

Local etiologies include oral and perioral infections, oral appliances, and decreased salivary flow. Elimination of taste complaint with topical anesthetic on the tongue is suggestive of local etiology. Central etiologies include injury to peripheral nerves (VII-IX) or CNS (e.g., Bell's palsy), tumor affecting taste pathway, endocrine disorders, gustatory aura with migraine or epilepsy, or aging.

If a Patient Has a Taste Change and Concomitant Oral Infection

Consider infectious etiology (periodontal diseases, odontogenic abscess, fungal or viral infections):

- Symptoms: Bad taste; possible malodor; bleeding on brushing and/or flossing, symptoms of odontogenic infection i.e., pain/swelling
- History: Lack of regular dental care; poor oral hygiene practices; medical history predisposing patient to poor oral health (e.g., poorly controlled diabetes)
- Signs: Poor oral hygiene; periodontal disease (bleeding on probing, pockets, purulence), periapical abscess (swelling, purulence), fungal or viral infections (soft tissue lesions)
- Diagnostics: Radiographs; periodontal diagnostics; smear for candidosis
- Treatment: Oral hygiene instruction, periodontal therapy; extraction or root canal therapy for odontogenic abscess, antifungal or antiviral medications (Appendix 12, Table A12-4)

If Patient Has a Taste Change and Reports Having a Dry Mouth (Xerostomia)

Consider salivary hypofunction (insufficient saliva decreases the distribution of tastant to the taste buds):

- Symptoms: Taste changes; xerostomia; possible dry eyes
- History: Temporally related to a new xerogenic medication(s); history of radiotherapy for head and neck cancer; diagnosis of Sjögren's syndrome; poorly controlled diabetes
- Signs: Dryness of oral mucosa; thick or foamy saliva
- Tests: Salivary flow studies, work-up for Sjögren's syndrome (serology: anti-SSA and anti-SSB, salivary gland biopsy, lacrimal flow studies, imaging), hemoglobin A1C (for diabetes)
- Treatment: Modification/elimination of potential causative medications; hydration; sialogogues/pharmacotherapies (e.g., pilocarpine or cevimeline) (Appendix 12, Table A12-4)

If Patient Has a Taste Change and Reports Taking a New Medication

Consider drug metabolites (can be excreted in saliva):

- Symptoms: Taste changes (e.g., metallic, bitter, persisting sweetness, saltiness)
- History: Temporally related to a new medication(s) (there are more than 100 medications reported to cause taste disorders)
- Signs: None
- Diagnostics: None
- Treatment: Elimination of potential causative medications

If Patient Has a Taste Change and Reports a Recent Upper Respiratory Infection

Consider upper respiratory infection (URI):

- Symptoms: Taste changes; cough; cold symptoms; sore throat; symptoms of sinusitis
- History: History of URI
- Signs: Fever; productive cough; pharyngeal signs
- Diagnostics: Sputum; culture
- Treatment: Referral to appropriate clinician. May require antibiotics if bacterial, symptomatic relief if viral

If Patient Has a Taste Change Following a Dental/Surgical Procedure

Consider peripheral nerve injury (taste fibers to the anterior two-thirds of the tongue travel with the lingual nerve):

- Symptoms: Unilateral taste change to anterior two-thirds of tongue
- History: Temporal relationship of previous inferior alveolar nerve block or extraction of a lower third molar
- Signs: None

- Diagnostics: Abolished by diagnostic block of affected nerve
- Treatment: None. Consider surgical correction and/or corticosteroids

If Patient Has a Taste Change Following Unilateral Facial Drooping

Consider Bell's palsy (facial nerve palsy):

- Symptoms: Often preceded by mild pain around ear, sudden onset of taste changes
- History: Viral infection, but often idiopathic
- Signs: Unilateral motor weakness of muscles of facial expression (affects entire side of face)
- Diagnostics: None, clinically evident
- Treatment: Protect cornea with eye pad, pulse, high-dose corticosteroids. Most cases resolve, but may be permanent

If Patient Has a Taste Change and a History of an Underlying Systemic Disease

Consider taste disorders associated with systemic disorders such as diabetes mellitus, adrenal insufficiency, hypothyroidism and trimethylaminuria:

- Symptoms: Taste changes; symptoms associated with uncontrolled systemic diseases
- History: Systemic disease
- Signs: None associated with taste abnormalities; possible signs associated with systemic diseases
- Diagnostics: Laboratory testing
- Treatment: Medical control of underlying systemic disease

If Patient Has a Taste Change and No Clear Etiology

Rule out a central tumor:

- Symptoms: Recent onset of taste changes; often concomitant abnormal CNS symptoms (e.g., headache)
- History: None
- Signs: Abnormal cranial nerve examination (VII)
- Diagnostics: CT/MRI
- Treatment: Depends on type of tumor (benign or malignant)

Olfactory Disorders

Local etiologies include nasal/sinus disease, upper respiratory infection, smoking, intranasal cocaine, or head/neck radiotherapy. Central etiologies include head trauma, neurodegenerative disease, medications, chemical exposure, nutritional deficiency, endocrine disease, CNS neoplasm, cerebrovascular accident, olfactory aura, psychiatric, Sjögren's syndrome, lupus, or age-related changes.

If Patient Has Olfactory Changes and Reports Nasal/Sinus Disease

Consider nasal or sinus obstruction/infection, respiratory infection, intranasal use of cocaine:

- Symptoms: Changes in smell; nasal congestion/discharge; symptoms of sinusitis; frontal headache
- History: History of URI
- Signs: Deviated septum, possible erosion or even perforation of nasal septum/palate (cocaine use)
- Diagnostics: Endoscopy, CT/MRI
- Treatment: Referral to appropriate clinician, appropriate antibiotics for bacterial sinus infection, possible surgery for nasal obstruction

If Patient Has Olfactory Changes and No Obvious Etiology

Consider primary olfactory disease and rule out central/systemic etiology.

Dry Mouth/Xerostomia

Xerostomia is the subjective experience of a dry mouth, and salivary hypofunction relates to objective measurement of abnormal salivary flow. Xerostomia is most commonly a side-effect of polypharmacy, dehydration—either local (e.g., mouth-breathing) vs. systemic (e.g., poorly controlled diabetes)—head and neck radiotherapy, or salivary gland disease (e.g., Sjögren's syndrome) (Appendix 6, Table A6-5). Subjective and objective measures are generally concordant; however, it is possible for a patient to complain of dry mouth in the absence of objective findings and vice versa.

If Patient Reports Xerostomia and Takes One or More Xerogenic Medications

Consider medication-induced xerostomia (multiple medications predict a greater effect):

- Symptoms: Xerostomia; relieved when salivary flow is stimulated (i.e., when eating)
- History: Onset coincident with medication(s)
- Clinical signs: Range from no signs (mild disease) to possible loss of salivary pooling; frothy saliva; increased incidence of cervical caries; generally possible to stimulate salivary flow
- Diagnostics: Salivary flow studies (unstimulated flow rate often abnormal, stimulated flow rate generally normal), normal serology (e.g., anti-SSA and anti-SSB)
- Treatment: Hydration throughout day, salivary substitutes; sugar-free candies or gum; possible systemic pharmacotherapy (Appendix 12, Table A12-4), oral hygiene. Discuss with physician if xerostomic medication can be substituted

If Patient Reports Xerostomia and May Be Dehydrated

Consider a chronic disease state causing dehydration (e.g., diabetes, renal disease, excessive exercise, taking diuretics)

- Symptoms: Xerostomia
- History: Poorly controlled diabetes with polyuria; renal disease; other diseases causing fluid loss
- Signs: Loss in skin turgor/wrinkling; pseudomembranous candidosis
- Diagnostics: Salivary flow studies; fasting blood sugar/HbA1c; BUN, creatinine, electrolytes
- Treatment: Fluids; control of underlying systemic disease

If Patient Reports Xerostomia and Has a History of Head and Neck Cancer

Consider radiation-induced xerostomia:

- Symptoms: Xerostomia, may be unrelieved by stimulation (depends on degree of damage to glands)
- History: head and neck cancer, greater than 4,000cGy radiotherapy affecting major salivary glands; to a lesser degree radioactive iodine therapy for thyroid cancer may also affect salivary flow
- Signs: Mucosal evidence of dryness, thick/ropy saliva, increased caries, candidosis
- Diagnostics: Salivary flow studies (both unstimulated and stimulated flow rates are often abnormal)
- Treatment: Depends on degree of damage to glands; hydration throughout day, salivary substitutes, sugar-free candies or gum, and/or systemic medications such as pilocarpine or cevimeline (Appendix 12, Table A12-4), oral hygiene, fluoride, low-sucrose diet

If Patient Reports Progressively Worsening Xerostomia and Has No Obvious Etiologies

Rule out Sjögren's syndrome (primary or secondary). Differential diagnosis includes other systemic diseases (e.g., HIV disease, sarcoidosis, cystic fibrosis and others).

- Symptoms: Progressively worsening xerostomia; dry eyes and other sicca symptoms
- History: Autoimmune diseases (and family history), e.g., lupus erythematosus, primary biliary cirrhosis; systemic sclerosis, rheumatoid arthritis, and others
- Signs: Constant or fluctuating major salivary gland swelling, signs of associated systemic disease, increased caries, candidosis
- Diagnostics: Salivary flow studies, labial minor salivary gland biopsy or fine-needle aspiration biopsy of salivary gland, serology (e.g., anti-SSA, anti-SSB); lacrimal flow studies
- Treatment: Depends on degree of damage to glands; hydration throughout day, salivary substitutes, sugar-free candies or gum, and/or systemic medications (Appendix 12, Table A12-4), oral hygiene, fluoride, low-sucrose diet

Malodor/Halitosis

Bad breath is a frequent complaint by patients, although some patients are unaware they have halitosis. A diagnosis of “genuine” halitosis is associated with objective evidence of a cause (intra-oral or extra-oral). A patient who inappropriately perceives halitosis that is not apparent on examination is thought to have “pseudohalitosis” and a patient who continues to perceive they have halitosis despite a normal examination may have “halitophobia.”

If a Patient Presents with Genuine Halitosis Caused by Overt Intra-Oral Causes

Consider if malodor is caused by periodontal disease, acute necrotizing ulcerative gingivitis, necrotizing ulcerative periodontitis/stomatitis, pericoronitis, dental caries (rampant), dental abscess(es), coated tongue (hairy tongue), candidosis, salivary hypofunction, oral ulceration (chronic to acute), malignancy, osteonecrosis, dry socket, poor oral hygiene (including poor denture/appliance hygiene), smoking, ingestion of odiferous foods and beverages

- Symptoms: Halitosis
- History: Associated with underlying cause (e.g., odontogenic infection); dental history (i.e., hygiene practices, types of oral hygiene products)
- Signs: Periodontal, pocketing, poor oral hygiene, papillary necrosis of interdental papillae (acute necrotizing ulcerative gingivitis [ANUG]), overt caries; signs of odontogenic infection; draining sinus tract(s); signs of mucosal diseases; signs of salivary hypofunction
- Diagnostics: Objective findings of halitosis by organoleptic testing, ideally by two or more clinicians two hours after eating/drinking or toothbrushing. Patient should abstain for 24 to 48 hours from smoking or consuming odiferous foods/beverages (e.g., garlic, alcohol, spicy foods, coffee) and avoid perfumed body products. Other testing for volatile or other gases is secondary; other diagnostics to support underlying cause
- Treatment: Manage underlying cause(s); tongue brushing/scraping; proper denture hygiene; scaling/root planing; endodontic or exodontic treatment; mouth rinses (e.g., those containing chlorhexidine, essential oils, cetylpyridinium, or chlorine dioxide); toothpastes (e.g., those containing triclosan); breath-fresheners (e.g., mints, chewing gums, etc.); antibiotics; tobacco cessation

If a Patient Presents with Genuine Halitosis Possibly Caused by Extra-Oral Causes

Consider if malodor is caused by upper respiratory disease (e.g., sinusitis, tonsillitis/tonsilloliths, malignancy, cleft palate, lung infection); gastrointestinal disease (e.g., gastro-esophageal reflux disease, *H. pylori* infection, malignancy); metabolic disorders (e.g., uncontrolled diabetes [acetone breath], end-stage hepatic or renal disease [uremic breath], trimethylaminuria [fish odor syndrome], or cystinosis [drugs containing sulfide moiety]).

- Symptoms: Halitosis
- History: Underlying medical conditions
- Signs: Absence of oral signs; signs of underlying medical conditions
- Diagnostics: Objective findings of halitosis by organoleptic testing (see above), ideally through mouth and nose; other testing for volatile or other gases are secondary; other diagnostics to support underlying cause (e.g., fasting blood glucose/HbA1c, liver or renal function testing, imaging)
- Treatment: Manage underlying cause(s)

If a Patient Presents with No Objective Findings of Genuine Halitosis

Consider pseudohalitosis or halitophobia:

- Symptoms: Halitosis; often perceived to be verified by the actions of others but truly unverified
- History: None other than possible underlying psychological/psychiatric history
- Signs: Absence of intra-oral and extra-oral signs
- Diagnostics: No objective findings of halitosis by organoleptic testing (see above)
- Treatment: Reassurance; if patients persist in the belief they have halitosis, consider referral for psychologic/psychiatric evaluation (possible personality disorder, obsessive-compulsive disorder)

Slow Healing

Patients who heal slowly following treatment for infections or dental procedures (e.g., periodontal or oral surgery), or who have traumatic lesions that heal slowly or do not heal need to be reassessed for possible misdiagnosis, mistreatment, or underlying causes of immunosuppression that could delay healing. In some cases, cardinal signs of infection may be lacking. Traumatic ulcers in patients with salivary hypofunction and movement disorders (i.e., oral dystonia) are often slow healing.

If a Patient Takes Longer Than Expected to Heal from an Infection Following an Invasive Dental Procedure

Consider underlying causes such as immunosuppression, for example, poorly controlled chronic diseases (HIV disease, diabetes, anemias, myeloproliferative cancers, hypothyroidism, or end-stage renal/hepatic disease, or other diseases), or patients on immunosuppressant medications. Differential diagnoses include dry socket (in cases of slow healing following extraction); iatrogenic causes (e.g., inappropriate diagnosis or management of an infection); or possible malignancy (misdiagnosed as an infection)

- Symptoms: Variable (e.g., pain, burning, limitation in function, xerostomia)
- History: Recent oral infection, oral ulceration, or invasive dental procedure; possible medical history associated with immunosuppression; medications associated with oral dystonia/tardive dyskinesia; tobacco use

- Signs: Possible cardinal signs of infection (although in severely immunocompromised patients some of these signs may be diminished); persistent ulceration; salivary hypofunction; lymphadenopathy
- Diagnostics: Imaging; laboratory (complete blood count, microbiologic cultures/sensitivity [bacterial, fungal, viral], fasting blood glucose/HbA1c, etc.); biopsy
- Treatment: Depends on underlying reason; if a new infection, treat aggressively with antibiotic therapy; refer to appropriate clinician (e.g., infectious disease)

Swelling

Swelling may be the result of edema associated with infection (e.g., fascial space infection secondary to an odontogenic infection) or trauma (e.g., fracture), or as the result of a proliferation of tissue from a hypersensitivity reaction (e.g., orofacial granulomatosis), or a neoplastic process (benign or malignant). Swelling may be localized or found in multiple locations. Most of the causes have been covered in the previous section on altered mucosa or in other chapters.

Bleeding

Intra-oral bleeding may occur from the gingivae, sites of recent surgery, or intramucosally in the form of blood-filled bullae, petechiae, or ecchymosis. It is important to be able to distinguish local from underlying systemic causes.

If a Patient Has Prolonged Gingival Bleeding Following a Dental Prophylaxis

Differential diagnosis includes hereditary causes, secondary to underlying systemic disease, or periodontal disease.

- Symptoms: Possible gingival bleeding with minimal trauma
- History: Prolonged bleeding during/following dental probing, prophylaxis, or other invasive procedures (should generally stop within 10 minutes with local measures); rare with oral anti-platelet medications (e.g., prophylaxis vs. complications post cardiovascular stent placement) including aspirin, nonsteroidal anti-inflammatory agents, clopidogrel, ticlopidine, dipyridamole, but higher likelihood with combination of medications (i.e., aspirin and clopidogrel); possible concomitant medical conditions associated with platelet disorders
- Signs: Gingival bleeding upon probing or prophylaxis; possible pinpoint red dots distributed bilaterally over soft palate (petechiae); possible extra-oral ecchymosis
- Diagnostics: Laboratory; generally no decrease in platelet count
- Treatment: Consult with physician; generally no need to discontinue medications for routine dental care; local measures (e.g., cold gauze compresses). Note: Case reports of significant blood loss

If a Patient Presents Only with Oral Petechiae on Soft Palate and Does Not Take Anti-Platelet Drugs

Consider mild/moderate underlying platelet disorder (hereditary platelet diseases, e.g., von Willebrand's disease) or secondary to underlying systemic diseases (e.g., infectious mononucleosis). Differential diagnosis includes palatal trauma from repeated coughing, sucking/rubbing of area in response to pharyngeal infection/allergies or fellatio); erythematous candidosis

- Symptoms: Possible spontaneous gingival bleeding, possible fatigue if patient has concomitant anemia
- History: Possible prolonged bleeding during/following dental probing, prophylaxis, or other invasive procedures; heavy alcohol use; possible medical conditions associated with platelet disorders; possible medications with anti-platelet activity (e.g., antibiotics) or violent coughing with trauma to the palate
- Signs: Pinpoint red dots distributed bilaterally over soft palate; possible fever/lymphadenopathy (infectious mononucleosis); other signs associated with underlying systemic causes
- Diagnostics: Laboratory (complete blood count looking for a decrease in platelet count), specialized tests to rule out systemic diseases (e.g., von Willebrand factor, clotting factor VIII, autoimmune diseases [e.g., systemic lupus erythematosus], infections, myeloproliferative cancers, renal or hepatic disease)
- Treatment: Based upon underlying cause, refer to hematology or other appropriate clinician

If a Patient Presents with Spontaneous Gingival Bleeding and Does Not Take Anti-Platelet Drugs

Consider moderate to severe underlying platelet disorder (hereditary platelet diseases (e.g., von Willebrand's) or secondary to underlying systemic diseases (e.g., emerging myeloproliferative cancer [i.e., leukemia], idiopathic thrombocytopenia purpura, or end-stage renal disease). Differential diagnosis includes periodontal/gingival diseases.

- Symptoms: Gingival bleeding (e.g., blood on pillow) upon slight provocation; possible fatigue if patient has concomitant anemia
- History: Prolonged bleeding during/following dental probing cleaning or other invasive procedures; possible medical conditions associated with platelet disorders
- Signs: Possible erythematous/swollen gingiva (possible oozing or blood clots), blood-filled bullae or intra-oral ecchymosis (bruising); possible pinpoint red dots distributed bilaterally over soft palate; possible extra-oral ecchymosis
- Diagnostics: Periodontal evaluation; radiographs, laboratory (complete blood count looking for a marked decrease in platelet count, usually less than 40K or other associated changes in RBC or WBC indices), specialized tests to rule out systemic diseases (e.g., von Willebrand factor, clotting factor VIII, autoimmune diseases, infections, myeloproliferative cancers, renal or hepatic disease)
- Treatment: Based upon underlying cause; refer to hematology or other appropriate clinician

If a Patient Presents with Prolonged Bleeding Following Dental Extraction or Alveolar Surgery

Consider underlying clotting disorder acquired secondary to oral anti-coagulant medications. Differential diagnosis includes iatrogenic causes (improper surgical technique), hereditary coagulopathies, or other underlying systemic diseases.

- Symptoms: Prolonged bleeding following dental surgery (longer than twelve hours); possible fatigue (if patient has concomitant anemia secondary to blood loss)
- History: Prolonged bleeding during/following dental procedures; patient is taking oral anti-coagulants (e.g., warfarin, dabigatran) for thromboembolism prophylaxis (e.g., valve replacement, atrial fibrillation)
- Signs: Bleeding/oozing from surgical site; no signs of platelet-related disorders
- Diagnostics: Laboratory assessment, international normalized ratio (INR) if patient is on warfarin
- Treatment: Local measures; if INR is greater than 3.5 and extensive surgery consider hospitalization for supportive care and possible vitamin K infusion; refer to hematology or other appropriate clinician; plan carefully with physician for future surgeries to avoid bleeding

If a Patient Presents with Prolonged Bleeding Following Dental Extraction or Alveolar Surgery and Is Not on Oral Anti-Coagulant Therapy

Consider underlying end-stage hepatic disease (e.g., alcoholic cirrhosis, primary biliary cirrhosis). Differential diagnosis includes iatrogenic causes (improper surgical technique), hereditary clotting disorders (e.g., hemophilia A or B, von Willebrand's), or other underlying systemic diseases.

- Symptoms: Prolonged bleeding following dental surgery (longer than 12 hours); possible fatigue (if patient has concomitant anemia secondary to blood loss); other symptoms associated with end-stage liver disease
- History: Prolonged bleeding during/following dental or other surgical procedures; possible history of ascites, varices, etc.; alcohol use
- Signs: Bleeding/oozing from surgical site; possible signs of end-stage liver disease (ascites, jaundice, etc.)
- Diagnostics: Laboratory (complete blood count; may see decrease in platelets), INR, prothrombin time, partial thromboplastin time
- Treatment: Local measures; if INR is greater than 1.5 and extensive surgery consider hospitalization for supportive care; refer to gastroenterology or other appropriate clinician; plan carefully with physician for future surgeries to avoid bleeding

If a Patient Presents with Prolonged Bleeding Following Dental Extraction or Alveolar Surgery, with No Underlying Hepatic Disease, and Is Not on Oral Anti-Coagulant Therapy

Consider hereditary clotting disorder (e.g., hemophilia A or B, von Willebrand's). Differential diagnosis includes iatrogenic causes (improper surgical technique) or other underlying systemic diseases.

- Symptoms: Prolonged bleeding following dental surgery (longer than 12 hours); possible fatigue (if patient has concomitant anemia secondary to blood loss)
- History: Lifelong history of propensity for prolonged bleeding during/following dental or other surgical procedures; hemarthrosis
- Signs: Bleeding/oozing from surgical site; no signs of platelet-related disorders
- Diagnostics: Laboratory (complete blood count to assess blood loss); PT, APTT, fibrinogen, specialized tests for hemophilia (clotting factors VIII, IX)
- Treatment: Local measures; consider hospitalization for supportive care and possible blood/factor transfusion; refer to hematology; plan carefully with physician for future surgeries to avoid bleeding

Altered Oral Function

The loss or compromise in the ability to speak, smile, masticate, taste, or swallow can have a great impact on a patient's quality of life. Altered oral function may be related to loss of teeth (and other masticatory structures) or loss in nerve function of vascular supply. Developmental defects (e.g., cleft lip or palate), deeply infiltrative malignant neoplasms (and their management), central pathology (e.g., stroke, brain neoplasms, or neurodegenerative diseases [e.g., Parkinson's disease, ALS, or multiple sclerosis]), Bell's palsy, or deep infections can lead to altered oral function. Most of these causes have been discussed previously or in other chapters.

Problems with Teeth

Tooth-related problems may be urgent (i.e., odontogenic trauma, pulpitis, or infection) or non-urgent (i.e., changes in number of teeth, changes in tooth [crown and root] morphology, mobility, malocclusion, discoloration, attrition, abrasion, erosion, or eruption disturbances). Problems with teeth may be linked to underlying systemic diseases.

If a Patient Presents with an Abnormal Number of Teeth

Consider congenitally missing teeth (which may or may not be associated with a hereditary disorder) or supernumerary teeth. Differential diagnosis includes tooth loss secondary to extraction because of odontogenic infection/periodontal disease.

- Symptoms: Often an esthetic complaint
- History: Missing or extra primary or secondary teeth
- Signs: Third molars/wisdom teeth most commonly missing teeth, followed by lateral incisors; mesiodens (found between maxillary central incisors) is most common supernumerary tooth; multiple supernumerary teeth associated with cleido-cranial dysplasia (also hypoplastic/missing clavicles) or Gardner's syndrome

- Diagnostics: Radiographic survey to rule out eruption issues
- Treatment: Multiple restorative pathways (implants, extractions, orthodontics, removable prostheses) to bring back form and function

If a Patient Presents with Generalized Changes in Tooth (Crown) Morphology and Structure

Consider hereditary disorder (e.g., amelogenesis imperfecta [AI], dentinogenesis imperfecta [DI]). Differential diagnosis includes idiopathic microdontia, ectodermal dysplasia, vitamin-D-associated rickets, renal osteodystrophy, hypoparathyroidism, alterations in morphology and structure caused by antineoplastic therapy/infections/malnutrition/birth-related trauma

- Symptoms: Often an esthetic complaint; possible pain/tooth sensitivity
- History: Enamel loss often occurs following eruption; all teeth affected; autosomal dominant or recessive, or X-linked
- Signs: Numerous different subtypes of AI and DI with variable patterns of enamel loss
- Diagnostics: Radiographic survey; genetic testing
- Treatment: Multiple restorative pathways to bring back form and function

If a Patient Presents with Intrinsic Tooth Discoloration Involving Multiple Teeth

Consider fluorosis or tetracycline staining. Differential diagnosis includes AI, DI, porphyria, erythroblastosis fetalis, or biliary atresia.

- Symptoms: Often an esthetic complaint
- History: Living in an area where water has high natural fluoridation; excessive fluoride ingestion; history of tetracycline intake; timing of exposure correlates with distribution of teeth affected
- Signs: Mild fluorosis can appear as white mottling of teeth, severe fluorosis can render enamel of affected teeth brown; tetracycline staining begins as an orange/red hue and darkens with exposure to light
- Diagnostics: None
- Treatment: Multiple restorative pathways to bring back natural esthetics (e.g., bleaching, laminate veneers)

If a Patient Presents with Extrinsic Tooth Discoloration Involving Multiple Teeth

Consider staining from beverages (i.e., coffee, tea, red wine), tobacco use, or areca nut chewing. Differential diagnosis includes mouth rinse use (e.g., chlorhexidine) or chromogenic bacteria

- Symptoms: Often an esthetic complaint
- History: History of use of foods or beverages that stain teeth; tobacco use (all forms); areca nut use (betel quid chewing (paan))
- Signs: Brown, black, red stains; can be removed by prophylaxis (with pumice for more tenuous stains)

- Diagnostics: None
- Treatment: Discontinue habits (tobacco, areca nut); regular dental prophylaxis

If a Patient Presents with Multiple Tooth Mobility Unrelated to Adult Periodontitis

Consider underlying systemic disease (e.g., HIV disease, leukemia, diabetes, neutropenia, dentinal dysplasia type 1, Down syndrome, scurvy [vitamin C deficiency], hypophosphatasia, Papillon-Lefèvre syndrome, leukocyte adhesion deficiency, or Langerhans cell histiocytosis). Differential diagnosis includes aggressive periodontitis.

- Symptoms: Loose teeth; possible pain
- History: Variable depending on underlying condition
- Signs: Tooth mobility; in most cases associated with bone loss (unless severe root resorption)
- Diagnostics: Radiographic series
- Treatment: Extractions, restoration (implants, fixed or removable prostheses); treatment of underlying medical condition

If a Patient Presents with a Worsening Malocclusion

Consider underlying systemic disease affecting bone growth (e.g., Paget's disease, fibrous dysplasia, odontogenic cysts and tumors, hyperparathyroidism, cancer infiltrating the jaws [e.g., metastatic breast or prostate cancer, multiple myeloma]).

If a Patient Presents with a Disturbance in Eruption of Teeth

Consider radiotherapy during tooth development, developmental delay, cleidocranial dysostosis.

If a Patient Presents with Radiographic Changes

Consider underlying systemic diseases, such as: radiolucent changes (e.g., metastatic malignancy, multiple myeloma, Ewing's sarcoma, Langerhans cell histiocytosis, or hyperparathyroidism); radio-opaque changes (e.g., osteosarcoma, Paget's disease, Gardner's syndrome, or fibrous dysplasia); widened periodontal ligament spaces (e.g., systemic sclerosis or osteosarcoma); floating teeth (e.g., neutrophil disorders or scurvy).

Suggested Reading

- Greenberg MS, Glick M, Ship JA (Eds.). *Burket's Oral Medicine: Diagnosis and Treatment*. BC Decker Inc., Hamilton, Ontario. 2008.
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4 Consultations

Consultations involve referring patients to another clinician or clinical service for an opinion and/or treatment concerning a specific problem.

Requesting and Answering Consultations

Triaging Consultations

Consultations (consults) should be prioritized, or “triaged,” on their degree of urgency. For example, trauma, hemorrhage, and infection, particularly in immunosuppressed patients, should be considered urgent requests for dental services and should be addressed as soon as possible. For non-acute consultation requests, an answer within 24 hours is acceptable, and a response on the same day is ideal. This might be specified in the hospital or departmental staff by-laws or policy manual.

The Different Types of Consultations

Whether seeking or responding to a consultation request, there are different types of consultations:

- Opinion only; for example:
 - A cardiology consult may be requested for management assistance in a patient with extensive valvular disease at risk for infective endocarditis after an invasive dental procedure.

- A dental consult may be requested concerning the immediate need or timing for a dental treatment for a hospitalized patient.
- Opinion and treatment of a *specific* problem: This request is problem-specific and does not require comprehensive care for the patient.

Requesting Consults from Other Services

Standard consult request forms exist in most hospitals and should include the following information:

- Date
- Requesting service
- Service consulted
- Problem(s) to be addressed
- Questions to be answered
- Vital information of interest to consultant
- Whether you are seeking an opinion only regarding diagnosis and/or management or to transfer the patient and the provision of treatment to another consultant or service

When consulting physicians concerning the medical management of a dental patient, it is useful to include a description of the extent of the dental treatment contemplated with regard to anticipated stress, bacteremia, bleeding, and postoperative healing time. Availability, promptness, and quality often determine both the frequency of consult requests from other services and the nature of consultations.

Examples of Medical or Surgical Services

- Neurology/geriatrics for further assessment in the event of suspected dementia
- Internal medicine to assist in medical management of patients
- Anesthesiology for pre-general anesthesia assessment
- Specialist surgical services, especially for patients requiring general anesthesia to provide their dental care, but who also need other semi-elective surgical procedures under general anesthesia
- Psychiatry or psychology to assist in behavioral management issues, to address concerns regarding potential interactions with ongoing psychoactive medication regimens, and to assess suspected depressive illness
- Diabetic services to assist with diet issues and establishing appropriate glycemic control with appropriate diet control

Other Clinical Services Consulted as Dictated by the Patients' Needs

- Physical therapy for advice regarding such issues as assistance in transferring a patient between bed, gurney, wheelchair, and dental operatory, and addressing

physical rehabilitation related to temporomandibular joint dysfunction management and/or post intermaxillary fixation

- Occupational therapy to assist in the selection and fabrication of adjunctive oral health devices for patients with impairment of hands and arms
- Speech therapy for appraisal of suspected swallowing dysfunction or other oral motor function (e.g., speech, mastication). Also to assist in improving communication with an aphasic patient
- Pharmacy for advice regarding medication dose adjustments (e.g., patients with renal insufficiency/failure or liver dysfunction) and drug interactions
- Social work to assist in communicating with a patient's family and other health-care institutions, social services, and health financial services
- Nutrition/dietary to assist in nutritional assessment and planning and supplementation (e.g., soft diet) for newly edentulous patients

Answering Consult Requests from Other Services

Where Are You Going to Undertake Your Assessment of the Patient?

Does this examination need to take place bedside or can the patient be transferred to your department, with all the advantages of a dental chair, equipment (lights and mirrors), and access to radiographic equipment? Some patients clearly are not fit to be easily, or safely, transferred and are best seen bedside. For example:

- Patients on respiratory or neutropenic precautions
- Intubated patients, or those requiring intensive cardiopulmonary monitoring
- High-risk pregnant patients on strict bed rest
- Patients with significant physical impairment

When in doubt, examination should be conducted at the patient's bedside. Patients should almost never be brought to the dental clinic before reviewing the medical chart and seeing them bedside to ensure that there is no risk to the patient or dental clinic staff.

Bedside Oral Examination

Ensure that you have all the necessary equipment when conducting a bedside oral examination. Most medical/surgical wards stock gloves and tongue blades, but not a good source of light (headlight or flashlight) or dental mirrors. For minors and intellectually impaired people, consider having a member of the clinical staff of the hospital as a chaperone present for your interview and examination.

Patient Transport and Escorts

For patients sufficiently healthy and mobile to be seen in your office, ensure that they are transported in a wheelchair, if appropriate, with their medical chart.

Patients in wheelchairs are easier to examine and radiograph than if they are on a stretcher. Prior to their transfer, check if they have any intravenous fluids running or if they require continuous oxygen. Patients receiving medication intravenously, such as chemotherapy or antibiotics, or who are in constant need of oxygen, might require hospital transportation or a nurse escort both for transportation and for the duration of their visit to the dental clinic. This may be mandatory for patients with airways compromise, such as intermaxillary wiring or fixation.

Priority: The Patient's Point of View

A request or problem that might seem mundane to the dentist (e.g., an ill-fitting denture, chipped front tooth) can be a major concern and source of distress to the patient, the family, or the referring physician. Such requests also provide an opportunity to perform an oral examination on a patient who might not otherwise be seen by a dentist on a regular basis.

Reviewing the Patient's Records

The patient's records should be reviewed thoroughly. Note significant points in the medical history and hospital course. A concise but thorough note should be written, and significant findings and recommendations might need to be discussed with the physician verbally in addition to their inclusion in the written response. Effort should be made to minimize or eliminate dental jargon or terminology to ensure that the reader fully comprehends the response (e.g., "quadrant," "ortho," "endo," and "apex" mean very different things to physicians and dentists).

Avoid making recommendations that create work for the consulting physician (e.g., ordering/acquiring radiographs, oral debridement of blood clots, arranging appointments with the dental office).

Findings and treatment should be discussed with relevant members of the patient's family, if appropriate, and with the family dentist whenever possible.

Clarify who will perform any dental treatment that proves necessary, and who will be responsible for follow-up care.

Consult Format

The first line of your entry in the record should specify the date and time, your name, your level of appointment, and your service.

- Introduction, which includes:
 - Patient-identifying data
 - Date of admission
 - Reason for admission
 - Reason for consult
- Chief complaint (CC): The concern for which the consultation was requested

- History of present illness (HPI): Brief summary of the development of the admitting diagnosis as well as the hospital course to date. The description of the complaint should include:
 - Location
 - Duration
 - Intensity and character of the complaint
 - Aggravating factors
 - Treatment for the problem if any. It should be clear to the requesting clinician that the chart has been reviewed and that significant findings were taken into account in making subsequent recommendations
- Past medical history (PMH), which includes:
 - Illnesses
 - Hospitalizations
 - Operations
 - Allergies
 - Medications
 - Relevant laboratory investigations and any radiology/imaging reports, with dates
- Past dental history (PDH): Relevant information about previous dental treatment; for example, recent extractions and how the patient fared in terms of postoperative bleeding or delayed healing. Such information may be critical to assess the patient's fitness to undergo invasive dental procedures
- Social history: Use of alcohol, tobacco, recreational drugs
- Family history as it relates to the medical condition or dental problem
- Vital signs, e.g., blood pressure, pulse, respiratory rate, temperature, oxygen saturation
- Inspection of general state of health: General appearance, body habitus, state of nutrition, posture and gait, speech
- Findings on *examination* should include a head and neck and intraoral examination regardless of the reason for the consult, with cranial nerve review if indicated. Significant negative and positive findings are noted. This section is descriptive rather than diagnostic and should avoid terminology that will not be understood by all concerned (e.g., use "maxillary right first molar," not "tooth number 3")
- Impression or *assessment*: All differential diagnoses should be included in decreasing order of likelihood. Because the reader may not be familiar with the impact of specific dental disease on the patient's medical status, elaboration of the diagnosis and the implications for medical management may be indicated
- Recommendations or suggestions: The consultant is essentially a guest of the requesting service, as the admitting physician is ultimately responsible for the patient and all treatment rendered. Hence, only recommendations or suggestions are made. No treatment is performed without discussion with the admitting doctor or responsible house officer. It is often helpful for the treating clinicians and the nursing staff to note in the patient record the date, time, duration, and venue for any planned dental treatment. It also might be appropriate to include a brief description of the significance of the problem to support the recommendations. All findings are addressed, especially the reason for the consultation

- A statement as to whether or not the patient will be followed by the dental service, followed by: consultant's signature, consultant's printed name, and the best way(s) to be contacted (phone/pager number)

Examples of Consultation Requests from Other Clinical Services

Most of the following examples are adapted from consults written by general practice residents in dentistry. Some material has been updated to ensure that drugs and procedures are current. These examples serve as a guide to format and to illustrate standard approaches to the evaluation and management of typical oral problems of hospitalized or medically complex patients. Note that although there are a variety of writing styles in these examples, they all address the reason for consultation.

Urgent/Acute Consultation Requests

Dental Consult 1: Dental Trauma Following Motor Vehicle Collision (MVC), Risk of Aspiration

Date/time:

Reason for consult: Asked by the trauma surgeons to evaluate dental trauma and risk of tooth aspiration in 33-year-old man with facial trauma and right tibia/fibula fracture following MVC. Plan for deflation of endotracheal tube (ETT) in near future.

HPI: Struck by a high-speed vehicle, thrown approximately 50 feet. When found by paramedics he was tachycardic, BP 120/60. His mouth was "full of blood" and there was no response to verbal commands. Noted large, soft hematoma left scalp. Several anterior teeth noted to be "unstable." No skull fracture on computed tomography (CT) but evidence of diffuse brain swelling. No rhinorrhea or otorrhea. Cervical spine without fracture. During suctioning of mouth earlier this a.m. a nurse suctioned a "portion of tooth." Now asked to assess stability of remaining dentition to allow for ETT cuff deflation without risk of aspiration of segments of teeth or subsequent fracture of teeth.

Past medical history: Unknown.

Past surgical history: None known.

Past dental history: Unknown.

Labs: (Date) White blood cell count: 13.4K/uL; hematocrit 31%; platelets: 101 K/uL

Sodium: 132 mmol/L Chloride: 104 mmol/L BUN: 6md/dL

Potassium: 3.7 mmol/L Bicarbonate: 24 mmol/L Creatinine: 126 mg/dL

Allergy: No known drug allergies

Current meds: Potassium chloride, phenytoin, penicillin, Mylanta®, acetaminophen

Vitals: BP: 140/85 Temperature: 98.6 Pulse: 80 Respiratory rate: 16

Examination:

N.B. exam limited by patient's level of consciousness, immobility, intubation and obesity.

Extraoral: Upper lip with sutured laceration with minimal oozing. No deviation with opening of jaw. Maximum opening approximately 30mm. No tenderness to temporomandibular joint areas. No mobile segments of mandible. No facial asymmetry, subconjunctival hemorrhage, or mobility of maxillary segments relative to zygoma or forehead. Neck supple but exam limited secondary to obesity.

Intraoral: Extremely limited exam.

1. Hard and soft palate: No lesions
2. Floor of mouth: Minimally observed. However, no ecchymosis or trauma noted
3. Tongue: Much debris, thick secretions
4. Buccal and labial mucosa: Upper lip with large ecchymosis and shallow laceration (poorly visualized). No active hemorrhage noted throughout mucosa
5. Gingiva: Pink; stippled; good contour without hemorrhage, laceration, or evidence of trauma, except for maxillary right anterior region
6. Dentition: Coronal aspect of maxillary right lateral incisor is missing, possibly avulsed or fractured—cannot visualize a root in the socket. Surrounding gingiva is ecchymotic, with coagulated blood covering the socket. Maxillary right canine slightly mobile and with vertical fracture through dentin to gingival margin, missing entire facial aspect. Maxillary central incisors show slight mobility with “crazed” lines in enamel. Maxillary left lateral incisor with small uncomplicated incisal chip fracture. Lower anteriors with several small incisal chips and hairline fractures. Posterior teeth appear to be grossly intact
7. Alveolar bone—anteriorly—no mobility of maxilla or alveolus, whole or segmental.
8. Occlusion: No evidence of open bite occlusal disharmony. No step-off occlusion
9. Oropharynx: Not able to observe

Assessment: 33-year-old male following MVC with multiple traumatic injuries to the head and facial regions, still with ETT intubation and limited responsiveness. There is no clinical or radiographic evidence of Le Fort I or II fractures. Possibility of alveolar fracture but unlikely from exam findings. Maxillary right lateral incisor in need of radiographic evaluation to determine if root is still present. Anterior teeth slightly mobile but splinting is not indicated. These teeth should be re-evaluated when his medical condition is stable and before giving solid foods. Maxillary right canine is in need of bonded composite resin coverage of exposed dentin to treat/prevent hypersensitivity. Teeth should not pose aspiration risk during or after deflation of ETT cuff. Intraoral soft tissue trauma requires debridement only

Recommendations:

1. Suction mouth with soft plastic/rubber tubing, not metal or hard plastic tip
2. Rinse/lavage for oral debridement of accumulations. Some practitioners utilize chlorhexidine rinses
3. Soft diet when taking food by mouth
4. Panoramic radiograph and dental periapical films of anterior teeth when able to transport to dental clinic to rule out fracture of alveolus, teeth/roots, condyles, etc.
5. May need extraction/root canal treatment of traumatized teeth in the future

Thank you for this consult. We will follow.

Signature:

Printed name:

**Phone/pager
#:**

Comments

- Note that the description of the intraoral findings uses as little dental jargon as possible for the benefit of the physicians and nurses caring for this patient, but that there is a thorough baseline documentation of significant positive and negative findings.
- Significant negative findings (e.g., lack of jaw deviation, tenderness, occlusal disharmonies, mobile segments) are especially important in the evaluation of the maxillofacial trauma patient.
- The consult addresses the specific reason for the request (i.e., the safety of deflation of the ETT cuff). However, as no other clinical service has addressed the odontogenic trauma, a thorough appraisal of this region is desirable.
- Note that it was made clear that the exam was limited by the patient's consciousness/ability to follow commands, immobilization, and body habitus, and that subsequent clinical evaluations, with radiographs, may reveal additional problems.
- Note that it was made clear in the consult that the problems were not urgent and could be addressed when the medical condition stabilizes.
- While laboratory values are used consistently in consultations, electrolytes are most important for patients who are dehydrated, especially from vomiting and diarrhea, and the BUN and creatinine are important for patients with renal disease.

Dental Consult 2: Persistent Hemorrhage Following a Dental Extraction

Date/time:

Reason for consult: Asked to see this 18-year-old male who presented two hours ago with a three-day history of intermittent bleeding after extraction of a lower molar tooth by his family dentist. No previous history of difficulties with dental extractions.

HPI: Routine dental extraction performed three days ago because of advanced "decay," with pain and mild facial swelling two days prior to the extraction. He had some "mild bleeding" after leaving the dental office, but two to three hours after the extraction, it "bled a lot." He admits to spitting out blood since then. He returned to his dentist that afternoon and the socket was packed with "something" and sutures were placed, and he was advised to apply pressure with gauze. Overnight, he awoke to find pillow "coated in blood." Bleeding slows with pressure but does not stop and every three to four hours it starts to bleed more heavily. His mother took him to their family physician, who started antibiotics and also advised to apply pressure with a sponge. He presented to the Emergency Department. BP 120/80, HR 70, temp 100°F [37.5°C].

PMH/PDH: As per mother and patient, no known medical problems. Denies any history of easy bruising or problems with bleeding. No previous history of any surgery, including oral surgery or previous dental extractions. Routine dental treatment in the past without problems.

Labs: (Date) White blood cell count 11.2 K/uL; hematocrit 53%; platelets 353 K/uL

Allergy: No known drug allergies.

Meds: Amoxicillin 250mg three times per day.

Vitals: BP: 140/85 Temperature: 98.6 Pulse: 80 Respiratory rate: 16

FH/SH: Lives with parents. Mother has a history of being a “bleeder” following dental extractions, as do two of his maternal cousins.

Examination:

Extraoral: Conjunctiva, skin folds, and nail beds of normal coloration. Mild, tender, right submandibular lymphadenopathy. No trismus.

Intraoral: Mild bleeding from the socket of the right mandibular first molar, with a large friable sticky clot present over the socket.

1. Hard and soft palate, buccal and labial mucosa, floor of mouth and tongue without lesions, masses, or other abnormalities
2. Some bruising evident on the buccal and lingual gingiva and alveolar mucosa adjacent to the socket; no swelling or evidence of infection

Assessment: 18-year-old male with persistent bleeding but without local factors (smoking, etc.) except for spitting. His presentation, along with his family history, suggests the possibility of an inheritable bleeding diathesis, such as von Willebrand’s disease.

Recommendations:

1. Will attempt packing of socket with methyl cellulose, sutures, after attempt at hemostasis with topical thrombin
2. Gauze packing may help with tamponade
3. Admit for observation in light of persistent bleeding and concern regarding possible (but rare) bleeding into submandibular spaces and adjacent parapharyngeal spaces, with resultant risk of airway compromise
4. Suggest consultation with hematology service for investigations for possible von Willebrand’s disease and hemophilia or other coagulopathy

Thank you for this consult. We will follow-up with hematology as to result of investigations.

Signature:

**Printed
name:**

**Phone/
pager #:**

Comments

- The first surgical procedure of any kind for many patients involves removal of a tooth. The nature of the post-surgical bleeding, as well as personal and family history of bleeding, help form a differential diagnosis including inherited and acquired coagulopathies. However, local measures are often the mainstay of hemorrhage control.
- Von Willebrand’s disease (vWD) is the most common congenital bleeding diathesis, and therefore is a possibility for this patient. It is an autosomal dominant disorder, associated with quantitative and qualitative deficiencies of the von Willebrand factor, which binds platelets to endothelium, as well as stabilizing the factor VIII coagulation factor.

- Patients with vWD tend to present with a mix of bleeding derangements: Constant bleeding as they fail to form a stable clot complex (vWD) and intermittent bleeding as the clot continuously turns over (absence of factor VIII).
- Patients with mild forms of vWD disease (types I and II) usually can be satisfactorily managed in the outpatient setting with preoperative infusions of desmopressin, which induces and increases factor VIII release from the endothelial cells. More severe forms, including some types that are unresponsive to desmopressin, need factor concentrate.
- Collaboration with the hematology service is vital in determining the safest means of treating the patient.

Dental Consult 3: Acute Lymphocytic Leukemia and Oral Ulcers

Date/time:

Reason for consult: Asked to evaluate oral ulcers in a 75-year-old male with acute lymphocytic leukemia (ALL) admitted (date) with fever, neutropenia, and multiple oral ulcers.

HPI:

Last summer presented with fatigue, weight loss, splenomegaly, bone marrow biopsy consistent with lymphoproliferative disorder.

(Date): Splenectomy with improvement in symptoms and platelet count.

(Date): Recurrence of fatigue and weight loss; white blood cell count (WBC) 200K/uL; platelets 95 K/uL; hematocrit (HCT) 27%.

(Date): Admitted to this hospital with bone marrow biopsy suggestive of ALL, WBC 350K/uL. Treated with doxorubicin and prednisone with dramatic fall in WBC with anemia and neutropenia.

(Date): WBC 4.5 K/uL, HCT 24%, platelets 2.0K/uL. Complains mainly of fatigue and malaise. Presented to outside hospital (Date) for platelets (is this for an infusion?), found to be febrile to 103°F (39.4°C). Only localized complaints are multiple mouth sores.

PMH: As above.

Allergies: No known drug allergies.

Labs: (Date) White blood cell count: 13.4K/uL; hematocrit 31%; platelets: 101 K/uL

Sodium: 134 mmol/L

Chloride: 103 mmol/L

BUN: 37 mg/dL

Potassium: 4.6 mmol/L

Bicarbonate: 25 mmol/L

Creatinine: 1.7 mg/dL

Meds: Intravenous (IV) ceftazidime, tobramycin (IV), nystatin, sodium bicarbonate mouth rinses, calace, Tylenol®, Benadryl®, Mylanta®, milk of magnesia, allopurinol.

PDH: Last dental visit two months ago for reline of maxillary partial denture. Brushes three times/day. Regular every six-month care. History of several maxillary and mandibular root canal therapy treated teeth. Has had recent gingival bleeding but no dental abscesses. Mild herpes labialis about one/year. Upper and lower partial dentures, both three years old.

Vitals:

BP: 140/85

Temperature: 98.6

Pulse: 80

Respiratory rate: 16

Examination:

Extraoral: Left cheek with small 1- to 1.5-cm ecchymotic area, no other lesions. No asymmetry, trismus, lymphadenopathy, tenderness to palpation. Neck supple.

Intraoral:

1. Soft/hard palate: Bilaterally along inner aspect of upper alveolar ridge, patchy 2-cm by 1-cm area of “curdy” white plaques with no surrounding erythema, removed with cotton tip. Shallow, 1-cm diameter, deep, red ulcerations with debris around margins in hamular notch/tuberosity area bilaterally, without tenderness or hemorrhage. Slight erythema of soft palate. Several scattered petechiae. Small ulcerations on anterior hard palate. No evidence of secondary infection. Oropharynx: generally erythematous, without purulence or exudate
2. Tongue: Pebbly, grainy appearance to dorsum. No plaques or lesions, slight erythema
3. Lips: Thin, dry mucosa. No cracking or ulceration
4. Buccal mucosa: Right posterior buccal mucosa with large diffuse, non-raised, non-tender 3-cm by 5-cm semilunar-shaped area of ecchymosis. No break in mucosa
5. Floor of mouth: Supple, no masses, lesions, ecchymosis, or debris
6. Gingiva: Multiple large “liver clot” areas of oozing hemorrhages surrounding upper teeth. No swelling but positive for edema, erythema, and debris. Lower anterior teeth with 2- to 3-mm recession, slight debris, blunt papillae, puffy margins with slight erythema. No bleeding, swelling, or purulence.
7. Alveolar ridge: Maxilla—generalized diffuse distribution of many small, less than 1-mm, erythematous, tender ulcerations with many petechiae; mandible—retromolar pad areas with bilateral 1-cm diameter hematomas with slight ulceration
8. Dentition: All upper remaining teeth have had root canal treatment. All teeth with I-II/III mobility. Sensitivity to percussion maxillary right premolars. Lower teeth with multiple crowns. No caries or sensitivity noted
9. Prosthesis: Upper and lower removable partial worn 24 hours/day continuously until (date)
10. Vestibules: Upper with generalized erythema and several small areas of ulceration
11. Salivary flow: Saliva was expressed from all ducts with grossly normal consistency

Assessment: Very pleasant 75-year-old male with fever and neutropenia, about 14 days following chemotherapy for ALL, now with several mouth problems from long-standing periodontal disease and denture use during chemotherapy.

1. Multiple hematomas, petechiae, and ulcers on upper and lower alveolar ridge, palate, and buccal mucosa secondary to denture trauma superimposed on friable mucosa and severe thrombocytopenia following chemotherapy. No evidence of secondary bacterial infection at this time
2. Candidiasis: White material on palate is candida secondary to neutropenia/chronic denture use
3. Gingival bleeding: Bleeding around upper teeth due to thrombocytopenia and long-standing inflammation from periodontal disease. Cannot rule out the possibility of periodontal abscess/severe periodontal disease without dental radiographs and a more thorough and invasive oral examination
4. Right tooth sensitivity: As all remaining upper teeth have had recent root canal therapy, any of these could be a potential source. The sensitivity to pressure on the upper right could represent a failing root canal or a periodontal abscess, aggravated by increased forces placed upon the tooth by the denture in function. Radiographs needed to help rule out the possibility of a periapical/periodontal infection. These are a possible source of fevers along with the chronic bacteremia from his periodontal disease

(Continued)

Recommendations:

1. Continue current broad-spectrum antibiotics, which should cover the mixed oral flora. Observe closely for secondary infection of hematomas/ulcers
2. Consider fluconazole for control of fungal infection
3. Consider antiherpes virus prophylaxis with valacyclovir
4. For pain: 2% viscous xylocaine or benzydamine HCl or diphenhydramine/Kaopectate® 50:50 rinse for 30 seconds and spit. Ice chips, sugar-free popsicles
5. Dentures strictly out of mouth for now. Scrub dentures and denture cup with disinfectant hand soap and warm water. Soak dentures in denture cleaner
6. Irrigation with water 1:3 rinses every three to four hours, swish/expectorate (as tolerated). Some practitioners prefer chlorhexidine
7. Neutral sodium fluoride 5 cc qHs swish/expectorate (as tolerated with ulcers)
8. Soft diet
9. Use care with sublingual thermometers because they can traumatize the thin, dry, friable mucosa
10. Debridement of all soft and hard tissues with wet 4-by-4 gauze sponges four times/day.
11. Will discuss with medical house officer the possibility of obtaining dental radiographs to rule out periapical and periodontal abscesses, but would prefer to do this when WBC and platelet count increases, as the yield from this test is low and radiographs are difficult to accomplish bedside.

Thank you for this consult. We will follow with you.

Signature:

**Printed
name:**

Phone/pager #:

Comments

- Neutropenic patients do not have the usual oral manifestations of acute infection that might cause a temperature of 103°F (39.4°C). Therefore, swelling, edema, erythema, and pain can be muted. The oral cavity in this patient cannot be ruled out as the source of his fever, even though he has minimal signs and symptoms of an oral abscess or cellulitis.
- Invasive dental treatment, to include periodontal probing, should be deferred until after the white blood cell counts recover from their nadir (lowest point), except perhaps in the rare situation when a dental infection is shown to be the source of a fever in a neutropenic patient whose counts are not expected to recover in the next 24 to 48 hours.

Dental Consult 4: AIDS with Multiple Oral Problems

Date/time:

Reason for consult: Asked to evaluate this 31-year-old male recently diagnosed with *Pneumocystis carinii* pneumonia (PCP) presenting with dysgeusia dysphagia, fever and dehydration.

Response:

HPI: Diagnosed with human immunodeficiency virus (HIV) one year ago. He refuses antiretroviral therapy. Has elevated liver function tests, (+) HBcAb, (–) HbsAg on (date). Onset of lymphadenopathy, oral candidiasis, malaise, fatigue, dry cough, about 20-lb weight loss.

(Date): Admitted to this hospital with diffuse bilateral chest infiltrates, transbronchial biopsy was positive for PCP. Treated with trimethoprim/sulfamethoxazole for eight days with improvement. Also had skin biopsy of right arm lesion positive for Kaposi's sarcoma (KS), no treatment.

(Date): Discharged to home. Subsequently developed fevers, shaking chills, night sweats, dehydration, perirectal pain. Temp. 102°F (38.9°C).

(Date) Presented for readmission febrile with decreased oral intake and increasing dysphagia. Physical exam on admission significant for II/VI systolic ejection murmur, white curd-like exudate on tongue and buccal mucosa. Chest film showed worsening interstitial infiltrates middle/lower lungs bilaterally since (Date). Hospital course thus far: Has been afebrile for three days. Oral complaints decreased following three days of clotrimazole. Noted "metallic" taste × 10 days, attributed to Flagyl taken recently for perianal pain/abscess. Very dry oral cavity. Feels "something going on" in region of the right tonsil, like it's "falling apart" and a "lump in my throat" when swallowing. No odontogenic pain or complaints. He reports increased viscosity of oral secretions and H₂O₂:H₂O (hydrogen peroxide/water) rinse "burns." Also reports alterations in taste since on medications, with subsequent decrease in oral intake.

PMH:

1. As above
2. Syphilis treated with penicillin, but developed rash
3. Hepatitis A about five years ago
4. Depression

Allergy: Penicillin

Meds: Pentamidine—stopped (Date), fluoxetine, Metamucil®, Colace®, nystatin, clotrimazole, H₂O₂:H₂O oral rinses, heparin flush

Labs: (Date) White blood cell count: 13.4 K/uL; hematocrit: 31%; platelets: 101 K/uL

Sodium: 139 mmol/L

Chloride: 102 mmol/L

BUN: 14 mg/dL

Potassium: 0.1 mmol/L

Bicarbonate: 28 mmol/L

Creatinine: 1.6 mg/dL

(Date): CD4 count = 40 cells/mm³; HIV ribonucleic acid (by polymerase chain reaction) = 394,000 copies/cc

PDH: He reports every-12-month care. No history of endodontic or periodontal therapy, surgery, or trauma. Three times/day oral home care. He reports generalized gingival bleeding with brushing. Uses clotrimazole lozenge after each meal.

Vitals: BP: 140/85 Temperature: 98.6 Pulse: 80 Respiratory rate: 16

Examination:

Extraoral: Negative for swelling, trismus, lesions, asymmetry, or tenderness.

Intraoral:

1. Soft palate and uvula: Heavy mucous secretions. Diffuse erythema with many pinpoint, non-raised, 1-mm, round localized areas of erythema
2. Hard palate: Bilateral ecchymotic appearance second premolar region. Right side with distinct, nontender, raised swelling, approximately 0.5 cm. Tissue boggy and extremely dry. Much white mucous debris

(Continued)

3. Oropharynx: Generalized bilateral tonsillar erythema with increased size
4. Buccal mucosa and floor of mouth: No lesions, abnormalities, debris, or erythema noted
5. Tongue: Dorsum with moderate white coating, dry, granular. Localized areas of deep color down midline. Lateral/ventral aspects without lesions
6. Lips: Dry, chapped, with white debris. No lesions noted except erythematous and ulcerated commissures
7. Gingiva: Marginal and papillary erythema, especially posteriorly. Anterior with blunted papillae. Boggy consistency without stippling. Much plaque/debris interproximally
8. Dentition: Twenty-eight teeth present, intact, well restored. Posterior teeth with severe bruxism/abrasion with exposed dentin. No teeth sensitive to hot/cold or percussion. No mobility. Crowding with anterior teeth. Much interproximal staining
9. Oral hygiene: Fair to good
10. Salivary secretions: Decreased flow, increased consistency

Assessment:

Pleasant 31-year-old male with acquired immunodeficiency syndrome (AIDS), thrombocytopenia, immune suppression, and biopsy-proven PCP and Kaposi Sarcoma (KS), with recent admission for persistent fever in setting of neutropenia. Complicated oral picture consistent with AIDS. Generalized erythema of tissue with obvious oropharyngeal candidiasis, likely esophageal candidiasis, and clinically suspicious KS of the palate. Many oral problems need to be addressed.

1. Tongue/dysgeusia: Possibly secondary to Flagyl and/or chronic hepatitis. However, may also be secondary to changes on dorsum of tongue along with decreased salivary flow/increased viscosity
2. Dysphagia/nausea and vomiting: Probably due to esophageal or gastric candidiasis. Possibly secondary to Flagyl
3. Palatal purpura/ecchymosis with right-sided swelling, typical for intraoral KS with respect to location as well as appearance
4. Right tonsillar mass: Differential includes KS. However, benign mucosal polyp, lymphoepithelial lesions, salivary gland tumors, and squamous cell cancer cannot be ruled out; a biopsy will be needed
5. Diffuse palatal erythema: Possibly secondary to viral syndrome. However, more likely due to chronic candidal involvement of oral mucosa
6. Lip commissures: Angular cheilitis from chronic candidiasis
7. Xerostomia: From medication, dehydration, or diffuse infiltrative lymphocystis syndrome
8. Gingival bleeding: Most likely from increased plaque, inflammation from bacterial flora, and to a lesser extent due to decreased platelets. Gingiva flora may include candida

Recommendations:

1. Suggest otolaryngology consult for evaluation of tonsillar growth
2. Rule out esophageal candidiasis. Discontinue nystatin and clotrimazole. Add fluconazole 200mg now followed by 100mg qd. Suggest Infectious Diseases consult given immunosuppression and potential need for systemic candidal drug
3. Discontinue H₂O₂:H₂O as this is irritating and substitute sodium bicarbonate/H₂O or water. Brush with soft nylon toothbrush with fluoride tooth paste three times/day. Observe for bleeding if platelets drop below 40K/uL
4. Continue 0.12% chlorhexidine rinse, 15 cc twice/day; rinse for 30 seconds and spit
5. Neutral sodium fluoride 5.0cc qd swish and expectorate after 30 seconds if not irritating
6. Frequent water sips/ice chips to soothe mucosa

Thank you for this interesting consult. We will follow.

Signature:

Printed

name:

Phone/pager #:

Comments

- This is an example of several oral manifestations of AIDS. Oral disease in this patient would be improved if he was placed on highly active antiretroviral therapy and was able to comply with this drug regimen.
- Note that all significant findings on exam are addressed in the assessment and recommendations.

Dental Consult 5: Planned Aortic Valve Replacement and Poor Dentition

Date/time:

Reason for consult: Asked to evaluate poor dentition in this 51-year-old non-English-speaking Portuguese male admitted (date) for planned aortic valve replacement (AVR) tomorrow morning. Daughter serves as an interpreter.

Response:

HPI: Limited medical or dental care during his lifetime. Noted onset shortness of breath two years ago and chest pain several times since. Now with increasing shortness of breath (SOB), 2-pillow orthopnea, and lower extremity edema. Cardiac catheterization two weeks prior to admission showed aortic insufficiency with an ascending aortic aneurysm. Now admitted for AVR with question of disposition of patient's poor dental status.

PMH:

1. As above
2. Hypertension (HTN)
3. Rheumatic heart disease as a child

Allergy: No known drug allergies

Vitals: BP: 140/85 Temperature: 98.6 Pulse: 80 Respiratory rate: 16

Meds: Captopril, digoxin, Lasix®, Benadryl®

Labs: White blood cell count, platelets, hematocrit, electrolytes pending: Prothrombin time 12.5/10.4 seconds; partial thromboplastin time 24.2 seconds

PDH: No visit to a dentist during his lifetime. Daughter cannot recall that he ever brushes his teeth. Currently without oral complaints. No recent history of facial swelling or pain.

Examination:

Extraoral: Without masses, lesions, swelling, asymmetry. No temporomandibular joint trismus, crepitus. Without tenderness to palpation. Neck supple, without lymphadenopathy. Thyroid palpable.

Intraoral: Positive for fetor oris. Hard/soft palate, lips tongue, buccal mucosa all without lesions or abnormalities.

1. Oropharynx: Diffuse erythematous appearance without tonsillar enlargement. No evidence of purulence or exudate
2. Floor of mouth: Supple to palpation, without lesions, abnormalities
3. Gingiva: Generalized severe edema with erythematous appearance and overgrowth of tissues in posterior areas. No evidence of chronic sinus tracts
4. Dentition: 31 of 32 teeth present with missing maxillary right first molar. Mandibular left first and second molars and second premolar are decayed root fragments. Remainder of dentition with multiple small carious lesions, especially posteriorly. Much mature plaque and calculus, especially posteriorly in both arches, covering much of the tooth surfaces. No mobility or percussion sensitivity. No palpable alveolar swellings
5. Oral hygiene: Poor

(Continued)

Assessment: 51-year-old Portuguese, non-English-speaking male with thoracic aneurysm and HTN, awaiting AVR. His surgeon would like us to eradicate all existing oral infection prior to valvular surgery. As discussed with Dr. Smith by phone today, his mouth is likely to be a chronic source of bacteremia, which could seed his prosthetic valve, and he might not be adequately covered with antibiotics alone perioperatively. As a result of his gingival disease and heavy accumulation of plaque, any manipulation of the soft tissues (e.g., mastication, oral hygiene) will cause frequent oral bacteremia with a variety of oral pathogens. The grossly decayed mandibular posterior teeth probably have areas of chronic periapical disease as well. Full series of dental radiographs will likely support this. A thorough dental scaling should be performed prior to thoracic surgery under adequate antibiotic cover, to decrease the bacterial load and to improve the integrity of the oral soft tissues. All hopelessly carious teeth should be extracted as well. He is also in need of oral hygiene instruction.

Recommendations:

1. As discussed with the cardiothoracic surgeon, given the historical cardiac condition, consideration is being given to accomplishing both dental and thoracic surgery during one general anesthetic with double antibiotic prophylaxis to cover and shorten the anticipated bacteremia. Otherwise the cardiac surgery will need to be postponed until after dental needs are resolved. He is presently scheduled to be seen by the dental service at 08:00 tomorrow for radiographs and treatment planning
2. Antibiotic prophylaxis: Amoxicillin 2g by mouth 1 hour before sending to the dental clinic
3. Consider diazepam 10mg by mouth for apprehension prior to dental appointment
4. Brush teeth three times/day with soft nylon bristle brush using fluoride dentifrice. Fluoride rinse 5 cc rise (30 to 60 seconds) and expectorate

Thank you for this consult. We will contact you after his clinic visit tomorrow morning.

Signature:

**Printed
name:**

**Phone/pager
#:**

Comments:

- Ideally, all dental disease and infection should be addressed and resolved prior to cardiac valve surgery to minimize exposure of a prosthetic valve to acute or chronic bacteremia. However, the ability of the patient to tolerate such stressful dental procedures before cardiac surgery must also be considered. In some situations, dental treatment should be carried out in the operating room with intravenous (IV) sedation and anesthesia monitoring. In the case of severe cardiac compromise, dental treatment might have to be deferred until after cardiac surgery. A case can be made for treating some acutely ill cardiac patients in the operating room under general anesthesia immediately prior to thoracic surgery and with double agent IV antibiotic coverage. The only alternatives are postponing thoracic surgery and treating the patient in the dental clinic or in the operating room under a separate general anesthetic, which poses an increased risk to the patient as well as added financial burden. Each case must be evaluated carefully with consideration for the urgency of dental treatment and severity of cardiac compromise. Close consultation with the cardiac team is required.

Non-urgent Consultation Requests

Dental Consult 6: Tonsil Cancer and Poor Dentition, Pre-Radiation Therapy

Date/time:

Reason for consult: Asked to see this 58-year-old male admitted (date) with newly diagnosed T3 N2b MO squamous cell carcinoma (SCCa) of the right tonsil. Request for evaluation of dental status prior to planned surgery plus radiation vs. chemo/radiation alone.

Examination:

Extraoral: Enlarged right submandibular and deep cervical nodes temperomandibular joints within normal limits slight trismus (opens 24 mm interincisal distance) with guarding

Intraoral:

1. 3- × 5-cm exophytic mass of right tonsil extending onto base of tongue
2. Buccal and labial mucosa, vestibules, floor of mouth, lips, and palate are within normal limits. Clear saliva expressed from parotid glands
3. Gingiva are moderately erythematous and boggy. Generalized gingival recession in the lower anterior quadrant. Heavy plaque and calculus on all anterior teeth
4. Of 32 teeth, 29 are present; however 13 (mostly posterior teeth) are grossly decayed or are present only as root fragments. Anterior teeth have two-plus mobility
5. The patient has poor oral hygiene. Bilateral mandibular tori measuring to 1.5 cm in greatest diameter in the area of the premolars are present with thin overlying mucosa

Assessment:

Although bedside exam is limited, it is apparent that this patient with stage IV tonsillar cancer and has substantial dental neglect, with moderate to severe periodontitis, gross dental caries, multiple retained root fragments, and mandibular tori that may need removal prior to onset of radiation therapy if he is ever to wear a prosthesis

Recommendations:

1. Will arrange/discuss with ear, nose, and throat (ENT) house officer concerning the timing of transport to dental clinic for dental radiographs and clinical evaluation
2. Anticipate patient will need removal of all remaining teeth, alveoloplasty of all four quadrants, and bilateral mandibular tori reduction in the operating room under general anesthesia prior to radiation, preferably immediately prior to ENT surgery
3. Will coordinate care with ENT and radiation oncology, pending patient decision between cancer treatment options. The radiation oncology consult note suggests that a minimum of 6500/cGy external beam therapy is planned to the tonsils and bilateral neck to include the parotids and submandibular/sublingual salivary glands. Maxillary and mandibular alveolar bone distal to the canine teeth will be in the primary field of radiation. A minimum of seven days postextraction healing is desirable prior to beginning radiation therapy

Thank you for this consult. Will follow.

Comments

- An oral evaluation and appropriate dental radiographs are recommended so that active and potential sources of infection within the planned fields (ports) of high-dose external beam radiation, or near intraoral implant radiation (brachytherapy), can be identified and removed before the ablative cancer therapy, keeping in mind that the anticipated dry mouth will predispose to severe caries in teeth outside the radiation fields as well

- Preprosthetic surgical procedures, such as mandibular and maxillary exostosis reduction in a planned radiation field, must be completed prior to radiation, with enough time for mucosal healing. Alveoloplasty or alveolectomy performed at the time of extraction enhances healing by facilitating primary closure of extraction sites and provides an adequate denture-bearing ridge form without bony undercuts. Bone remodeling may be limited by radiation. It is ideal to perform the oral surgery immediately prior to (or after if indicated) the ENT surgery and under the same general anesthesia.
- For patients who are expected to develop xerostomia secondary to radiation therapy, the preradiation consult provides an opportunity to educate them on the oral sequelae of radiation therapy and the need for lifelong, daily, prescription strength topical fluoride therapy, a sugar-free diet, scrupulous oral hygiene, and close dental office observation.

Dental Consult 7: Myeloproliferative Disorder and Facial Swelling

Reason for consult: 47-year-old man with recently diagnosed myeloproliferative disorder for pain and progressive swelling in the left maxillary infraorbital region.

Examination:

Extraoral: Positive for left submandibular lymphadenopathy; significant left facial swelling suborbitally to nose, over entire left cheek, and zygomatic area. Tender to palpation, soft, fluctuant, erythematous and warm to touch, negative for trismus. Right eye with injected sclera.

Intraoral: Oropharynx, palate, labial and buccal mucosa, dorsal tongue, floor of mouth, and lips without lesions or abnormalities. Marked soft tissue swelling in left buccal vestibule/canine fossa with fluctuance extending posteriorly from left canine to left second molar region.

- Maxillary gingiva: Generally swollen and erythematous, and 1 cm asymptomatic, erythematous, nonraised lesion anterior to left second molar on alveolar ridge
- Mandibular gingiva: Marginal cuff of erythematous tissue with moderate, generalized plaque/debris
- Maxillary dentition: Right second molar fractured due to caries, missing palatal half of crown, root exposed, positive for furcation involvement, percussion sensitivity, grade 1 mobility. Periapical radiolucency on radiograph with widened periodontal ligament space
- Maxillary right canine with mesial and distal caries, asymptomatic, without percussion sensitivity or mobility. Radiograph reveals early periapical radiolucency/pathology. Left canine with gross distal caries involving one-half of clinical crown. Positive percussion sensitivity, grade 2 mobility. Radiograph reveals large 1-cm radiolucency at apex, widened periodontal membrane ligament space. Left second molar asymptomatic and without caries
- Mandibular dentition: All remaining teeth without lesions or symptoms.

Oral hygiene: Poor. Patient wears maxillary prosthesis but did not bring it on this admission. Partial denture is at least several years old.

Assessment: 47-year-old man with myeloproliferative disorder, hypertension, and diabetes, presents with fever and left facial swelling from maxillary left canine dentoalveolar abscess. With this degree of swelling a canine space infection is probable, even in a patient with a normal hematologic profile. He suffers from general dental neglect, caries, and chronic periodontitis. These should be addressed before myeloproliferative disorder progresses.

Comments

- In cases of facial cellulitis accurate description of the extent or borders of the swelling (i.e., anteriorly, posteriorly, superiorly, and inferiorly) is important for future reference.
- In this patient with evolving leukemia, a delay in dental treatment could be catastrophic. If a patient enters “blast crisis” (the final phase of chronic myelogenous leukemia [CML]) with neutropenia and thrombocytopenia, a dental infection might have to be managed medically until the hematologic status allows for surgical intervention.

Dental Consult 8: Endocarditis of Possible Dental Origin

Reason for consult: 38-year-old woman with Marfan syndrome, mitral valve endocarditis, Gram-positive bacteremia of possible dental source. Had recent strep throat as well as reported “boil” on gum.

Examination:

Extraoral: Face and neck without masses, lesions, or lymphadenopathy.

Intraoral: Soft palate, oropharynx, buccal mucosa, floor of mouth without evidence of abnormality. Bimaxillary micrognathia and high vaulted palate consistent with Marfan.

1. Lips: Dry, with slight crusting of blood
2. Tongue: Without lesions but dorsum has an accumulation of yellow plaque
3. Gingiva: Generally dark/dusky color, without noticeable stippling; slightly edematous with puffy interdental papillae, especially in mandibular anterior area. No lesion noted on alveolar mucosa in region of lower incisor where she described “boil”
4. Dentition: Generally without sensitivity to percussion, no mobile teeth. Several malpositioned anterior teeth. Poor occlusion. Many large, old amalgam restorations of questionable status
5. Oral hygiene: Fair to poor, with readily visible generalized accumulation of plaque and debris

Assessment: 38-year-old female with Marfan syndrome and endocarditis, with five out of five blood cultures positive for Gram-positive cocci. The reported “boil” adjacent to a tooth that received endodontic therapy in the past, as well as her overall dental/oral condition, makes her mouth a possible source. In addition, transient bacteremias are well documented following toothbrushing or any other manipulation of the gingiva. Finally, the timing of her probable strep throat suggests this as a possible portal as well. Speciation of the organism will help clarify the likely source. Dental radiographs would help to rule out a dental pathology associated with a failing root canal therapy or from defective restorations.

Recommendations:

1. Will discuss with her medical house officer and arrange for her to be seen in dental clinic for full mouth series of radiographs and a thorough oral exam. When medically stable, she will need dental scaling and possible extractions, preferably while still under IV antibiotic therapy
2. Need for replacement of defective restorations as soon as possible by family dentist or preferably by us while an inpatient and on IV antibiotics
3. Improve oral hygiene: Increase toothbrushing to twice/day with soft, nylon bristle brush. Will have our hygienist teach and encourage flossing
4. High concentration fluoride rinse 0.04% to 0.05 % or stannus or fluoride to arrest carious lesions, 5 cc daily at night, swish for 30 seconds and expectorate (or 1.1% neutral NaF gel brush-on application or 5,000 parts per million neutral NaF toothpaste use once daily)
5. Chlorhexidine mouth rinse: 15 cc twice/day rinse for 30 seconds and spit

(Continued)

Comments:

- Note that both the episode of pharyngitis and the reported evidence of chronic abscess can be temporally related to the endocarditis, that is, within two to three weeks of the onset of symptoms of endocarditis. The history of dental scaling six weeks ago is too far removed from the onset of her symptoms of infective endocarditis (IE) to be a cause. A further characterization of the species of organisms involved might differentiate it as to odontogenic vs. other (e.g., respiratory) origin.
- In general, the best time to provide dental treatment is between the time she becomes medically stable enough to undergo dental treatment and the time that her intensive antibiotic therapy ends. Prophylactic antibiotic coverage may be indicated (as per your national guidelines) for all invasive dental procedures because she is at high risk for IE in the future. Alternative antibiotics to the agents she is being treated with might be indicated to lessen the likelihood of a bacteremia with resistant organisms during invasive dental treatment. Keep in mind that the vast majority of cases of IE originating from the oral cavity are likely from chronic bacteremias rather than invasive dental procedures.

Dental Consult 9: Newborn Infant with Masses on Alveolar Ridge and Large Lingual Frenum

Reason for consult: Asked to see this approximately 24-hour male newborn for evaluation of masses on mandibular alveolar ridge and a lingual frenum.

Examination:

Extraoral: No abnormalities

Intraoral: Hard and soft palate, oropharynx, buccal mucosa, tongue, floor of mouth, lips all without abnormalities or lesions. Gingival/mandibular alveolar ridge with several bilateral sessile nodules in region of eventual canine teeth, approximately 6 to 8 mm in height, approximately 5 mm in diameter. Rubbery consistency. Yellow translucent membrane, with apparent straw-colored fluid inside. Vessels visible on membrane. Prominent lingual frenum almost to tip of tongue.

Assessment: Newborn male infant with benign, bilateral sessile mandibular nodules, most likely dental lamina cysts of the newborn, also commonly referred to as gingival cysts. Histologically, they are true cysts with an epithelial lining, filled with desquamated keratin. As in this case, they are usually displaced lingually when in the canine region. A lingual frenum of this size can interfere with breastfeeding, and if so, it can be shortened surgically in the newborn nursery.

Recommendations:

1. No treatment is required because these are gingival lesions which almost invariably open on to the surface mucosa. Will discuss with mother
2. If lactation consultant observes problems with breastfeeding, we will return to “clip” the frenum if deemed necessary

Comments

- This is a good example of the opportunity that consults provide to teach other services about dental disorders. The issue of when to perform a frenectomy is controversial and should be based initially on the infant's ability to breast-/bottle feed.

Dental Consult 10: Type I Diabetes, Failing Renal Transplant, and Poor Dentition

Reason for consult: Asked to evaluate the dentition of this 34-year-old male with long-standing type 1 diabetes mellitus, with a history of end-stage renal disease (ESRD), now eight days following cadaveric renal transplant.

Examination:

Extraoral: Yellow/gray complexion with many 0.2- to 0.4-cm blotchy areas on skin, especially forehead. Bearded, head and neck without masses, lesions, or adenopathy, negative trismus, negative asymmetry

Intraoral:

1. Hard and soft palate, lips, floor or mouth: Without lesions or abnormalities
2. Oropharynx: Diffuse pallor
3. Buccal mucosa: Pink, moist with bilateral granular/pebbly texture
4. Tongue: Left lateral border with 0.75-cm diameter shallow, tender ulceration with yellow fibrin-like covering. (He reports that he bit his tongue during anesthesia)
5. Gingiva: Generalized erythema, moderate edema. Anterior gingiva retractable due to severe inflammation, gross accumulations of mature plaque and calculus. Maxillary left canine and left first molar areas with submucosal "bluish" pigmentation in marginal 2 mm of gingiva. Recession anteriorly only. No purulence
6. Dentition: Missing maxillary left anterior teeth and mandibular right and left first molars. Periodontal involvement of all mandibular anterior teeth. Central incisors with grade 2 mobility. Several small amalgam restorations in posterior teeth. Gross caries maxillary right and left first premolars. Max right anteriors with gross decay such that only roots remain. No teeth are sensitive to percussion
7. Vestibules: No swelling or evidence of chronic sinus tracts
8. Salivary flow: Normal amount and consistency
9. Oral hygiene : Poor/non-existent

Assessment: 34-year-old male with ESRD, type I diabetes, now following cadaveric renal allograft with poor subsequent function, and long history of extreme dental neglect.

1. He has severe mandibular anterior periodontal inflammation and loss of alveolar bone. These teeth will probably require extraction after radiographic assessment. Several grossly carious maxillary anterior teeth may also need to be extracted
2. The blue-pigmented lesions are most likely secondary to subgingival calculus visualized through thin mucosa. However, these lesions may also be seen with ingestion of heavy metals (lead, bismuth). This will be clarified after calculus removal and possible gingival biopsy with histologic examination for submucosal metal deposition
3. Left tongue lesion probably secondary to trauma. However, with his history of heavy smoking and the possibility of malignancy, we should observe over the next 10 to 14 days to assure resolution
4. He is at high risk for infection, given his immunosuppression coupled with his poor periodontal status and large volume of bacterial plaque. He needs a more thorough dental exam, radiographs, and extractions of multiple teeth. It should be noted that with periodontal disease there is a localized shift in the oral flora from Gram-positives to Gram-negatives

(Continued)

Recommendations:

1. Will discuss with the attending physician the control of his hypertension (190/100 on [date]) and the desirability of increasing his steroid dose the day of surgery
2. Oral hygiene: Begin brushing with soft nylon, round-tipped brush twice/day, with fluoride toothpaste, mouth rinses with water, swish and expectorate four times/day to supplement brushing. Neutral sodium fluoride rinse after oral hygiene, 5 cc rinse for 1 minute and expectorate
3. Chlorhexidine mouth rinse: 150cc twice/day rinse for 30 seconds and spit

Comments

- Note that all significant findings on the patient's examination are addressed in the assessment, even though they might not be directly related to the reason for the consult.
- Considerations for dental treatment for patients on hemodialysis include scheduling treatment on the day following hemodialysis. Although there is little or no evidence supporting the use of antibiotic prophylaxis coverage for an immunocompromised state such as exists with renal transplantation, it has become routine in some hospitals due to the concern for infective endocarditis, if not for the dialysis shunt itself. Steroid supplementation in this setting is also controversial, but depending on the current dose, it might be prudent given the minimal risk involved from a dose to cover the procedure, and perhaps during the immediate (12-hour) postoperative period.

Dental Consult 11: Oral Ulcerations of Unknown Etiology

Reason for consult: Asked to evaluate and treat dry mouth and oral lesions in a 57-year-old woman with severe rheumatoid arthritis since age 21 and possible new onset of secondary Sjögren's syndrome (SS) (Appendix 6, Table A6-5).

Examination:

Extraoral: Erosive/crusted lesions on vermillion border of lower lip. No swelling of salivary glands, no lymphadenopathy.

Intraoral:

1. Mouth moderately wet
2. Floor of mouth, tongue, soft palate, and pharynx all benign in appearance
3. Large, 1- × 3-cm, velvety red areas with leukoplakic lesion midposterior hard palate
4. Erosive areas with irregular borders on labial mucosa
5. Large, diffuse, red and white, flat lesion on left buccal mucosa between Stensen's duct and the commissure
6. Multiple leukoplakic areas on occlusal line of buccal mucosa
7. Multiple carious and fractured teeth, calculus, debris, and gingival inflammation/swelling
8. Generalized gingival bleeding with probing

Assessment:

1. Erythema multiforme (EM): Erosive area of lip most consistent with EM but could be a lichenoid reaction. It is noteworthy that she is on Indocin®, which has been associated with ulcerative stomatitis as an idiosyncratic reaction. If possible, this drug should be discontinued to rule this out as an additional cause of the widespread stomatitis. Viral etiology is highly unlikely

2. Leukoplakia/erythroplakia: Need to watch to ensure these areas resolve with withdrawal of the offending drug (Indocin®)
3. With the report of a need to drink additional fluids while eating, secondary Sjögren's may also be a factor, but unlikely etiology of these lesions. Screening serology for SS/A and SS/B antibodies may be of value
4. Caries: Multiple teeth
5. Poor oral hygiene and gingivitis/periodontitis

Recommendations:

1. Immediate institution of oral hygiene:
 - a. 4 × 4 wet gauze on gloved finger to clean mouth, especially along gingival margin
 - b. Mouth rinses with water four times/day
2. If infectious etiology ruled out, consider steroid rinses for intra-oral lesions and Kenalog® in Orabase® to dried lip lesions
3. To dental clinic for:
 - a. Panoramic film, extraction of non-salvageable teeth, and cleaning of remaining teeth when lesions begin to resolve
 - b. Will wait to see if EM resolves, otherwise will need to consider biopsy of area suspicious for dysplastic change of the palatal and buccal mucosal lesions in light of significant smoking history. May need to consider stopping/replacing Indocin® if lesions do not resolve

Thank you for this interesting consult. Will discuss management of EM and need for biopsy with dental attending in a.m. Would like to photograph these lesions for comparison when medications have been altered.

Comment:

- This patient has a complex clinical presentation. A detailed and well-described oral exam is necessary for diagnosis and later comparison because changes in the clinical picture will help to determine the diagnosis, and therefore the management.

Dental Consult 12: Poorly Fitting Denture on an Atrophic Ridge

Reason for consult: Asked to see this 74-year-old female admitted five days ago for management of her rheumatoid arthritis (RA). Family requests evaluation for a replacement lower denture.

Examination:

Extraoral: No lesions, lymphadenopathy, or swelling.

Intraoral: Palate, buccal and labial mucosa, alveolar ridges, tongue, floor of mouth and pharynx, and other soft tissues are within normal limits. Patients is edentulous. Maxillary ridge firm and prominent, with good height. Maxillary denture has good retention. Mandibular ridge virtually nonexistent, causing poor retention of the mandibular denture.

Assessment: 74-year-old female with RA with atrophied mandibular ridge and poorly fitting lower denture

Recommendations: Since she has no lower ridge for retention of mandibular denture and she is functioning well without one, construction of a new prosthesis is not recommended. To do so would require approximately five weeks with five or six visits, some of which could be somewhat strenuous for her, and she is happy with the decision not to replace the lower denture. Recommend assessment and review by the Dietetics Service as to the adequacy of her diet. Will discuss with her family.

Comment:

- In responding to requests for dentures, it is important to note and consider who is making the request—the family, the patient, or a member of the health-care team. At times, the expectations for dentures may be unrealistic and the patient’s oral intake, motor control, mental status, ability to cooperate, and oral status should be assessed to determine the appropriateness of denture fabrication.

Dental Consult 13: Dental Clearance for Hematopoietic Stem Cell Transplantation

Date/time:

Request: Evaluate patient’s oral health

Reason for consult: Asked to evaluate the dental health of this 4-year-old male with acute lymphoblastic leukemia (ALL) for pre-hematopoietic stem cell transplant (HSCT) dental clearance.

Examination:

Extraoral: Revealed no trismus, no swelling, and no palpable lymphadenopathy.

Intraoral: Intraoral soft tissue exam was within normal limits for tongue, buccal mucosa, floor of mouth, gingival mucosa, and palate. Patient is in primary dentition with fair oral hygiene. He has areas of active decay on his maxillary second primary molars (A and J), mandibular primary first molars (L and S) and his right mandibular primary second molar (T). No acute infection was noted. No radiographs were taken.

Assessment:

1. Fair oral hygiene.
2. Active caries (from limited oral examination)

Recommendations:

1. Although this child has active dental caries, we will delay restoration due to urgency to begin chemotherapy
2. Will discuss with his oncologist a schedule to complete his dental treatment when his counts recover after chemotherapy and prior to bone marrow transplantation. This will likely be performed under general anesthesia due to the narrow window of time available for treatment and the patient’s non-compliance with treatment in the dental office
3. We discussed with the patient and his mother the risks, benefits, and alternatives to therapy including the importance of maintaining good oral hygiene during his medical treatment to prevent mucositis and further decay, and slow down the existing caries activity
4. Fluoride therapy applied by bedside

Comments

- Urgency of medical treatment to delay dental treatment until after chemotherapy
- Scheduling of dental treatment as there is a limited period during which treatment can be performed due to counts and bone marrow transplant schedule
- Consideration of treatment under general anesthesia due to compliance and time restraints

Dental Consult 14: High-Risk Pregnant Patient with Toothache

Date/time:

Reason for consult: Asked to evaluate this 24-year-old high-risk pregnant patient for tooth pain requiring hydrocodone 5 mg/acetaminophen 500 mg every eight hours. The patient is in her 25th week and on bed rest.

Examination:

Extraoral: Positive for slight facial swelling on left cheek, slightly tender to palpation. Lymph nodes nonpalpable, mouth opening normal, negative for dysphagia and dysgeusia

Intraoral: Patient has multiple carious teeth, poor oral hygiene, and generalized gingivitis. Left maxillary second premolar (#13) is grossly decayed and is very tender to percussion. This tooth is also slightly mobile. Moderate soft tissue swelling in the buccal vestibule near #13. Other carious teeth include maxillary right (#1) and left third (#16) molars, right maxilla canine (#6), mandibular left first and second molars (#19, #18), and right first premolar (#28). None of these teeth was painful on percussion. No other soft tissue pathology was appreciated.

Assessment: Pleasant 24-year-old female with high-risk pregnancy and odontogenic pain of tooth number 13 alleviated only by narcotics for past three weeks. Patient also with general dental neglect, dental caries, and periodontal disease.

Recommendation:

1. We will acquire intra-oral periapical dental radiograph of number 13 at bedside
2. Will discuss with primary team an appropriate time for extraction of this tooth. It is far preferable to perform this in the dental office; however, if this is not possible because of patient's condition, will do extraction at bedside

Comments

- In this case the covering OB/GYN insisted that the patient not be transported off the patient floor. General anesthesia was not an appropriate option. Also the tooth was significantly deteriorated and there was a concern that this would become a surgical extraction, posing significant difficulties if removed bedside.

Dental, Oral, and Maxillofacial Emergencies

CHAPTER 5

The management of dental emergencies in the hospital environment has evolved dramatically over the past few decades. While general and pediatric dentists, as well as oral and maxillofacial surgeons, once provided management that was limited to odontogenic problems on a consultation basis only, they are now often the primary providers of care and might manage everything from a simple toothache to the most severe maxillofacial maladies and craniofacial injuries. This natural evolution has brought with it many opportunities for both practitioners and trainees alike. It also carries with it a new level of responsibility, for now the dentist must be aware not only of the odontogenic emergency but also of all the local and systemic consequences of the patient's current emergency condition, as well as the overall medical status.

Emergency department (ED) organization varies from hospital to hospital. Smaller hospitals often have a single emergency facility staffed by members of the medical staff on a rotating basis, or by specialists in emergency medicine. Larger academic medical centers often have emergency medicine house officers as the primary staffing, with support by the emergency medicine faculty. These medical centers also commonly have several combined or distinct areas for the specific management of medical, surgical, pediatric, obstetric/gynecologic, and non-emergency problems.

Noncritical emergency patients are usually first seen by a medical secretary, clerk, or nurse, who obtains demographic data and starts a medical chart. When necessary, old medical records are requested to facilitate obtaining an accurate medical history. With the advent of electronic communications, large and well funded medical centers have electronic records and archives that may be accessed instantly. A nurse

triages the patient. The triage process involves an assessment of the problem, establishment of a priority for care, and assignment of the patient to an appropriate member of the medical/dental staff. The initial assignment of the patient varies by hospital. In some institutions, patients with isolated dental/oral or maxillofacial problems may be directly referred to and managed by a dentist. In other facilities, patients are first seen by the emergency physician who, after performing an examination and managing any medical conditions, consults a dentist about treating any oral/facial problem(s). A thorough knowledge of the organizational, triage, and treatment protocols in the emergency department greatly enhances the dentist's ability to provide rapid, appropriate, and broadly scoped emergency care.

Medicolegal Aspects of Emergency Care

Because the provision of emergency care is inherently acute and generally provided to new patients who are unfamiliar to the managing doctor and with the potential for morbid outcomes, the medicolegal aspects of care are of great importance.

Responsibilities of the Doctor

Appointment to a hospital staff obligates an attending or house-staff member to treat patients with emergency needs. Depending on the facility, emergency department care may be provided by dentists on a rotating basis or on an "as-needed" basis by specific consultation. No matter the administrative structure, emergency care should be provided in a timely fashion, both for the patient and for the efficient running of the emergency department.

Consent

As with any hospital procedure, a signed informed consent for treatment is a prerequisite for emergency management. The informed consent process is more than just obtaining written permission to manage the patient. Informed consent requires a full explanation of the diagnosis, potential management modalities; risks, benefits, and consequences of each; and time provided for the responsible individual to ask questions regarding the potential care to be rendered. For conscious adult patients this is not usually a problem. However, for children and for adults who are unable to give consent because of their level of consciousness, intellectual incapacity, neurological disease (e.g., prior stroke or Alzheimer's disease), or emotional/psychiatric instability, the informed consent process must be dealt with by alternative means. In the case of children, a parent or legal guardian can give consent. If an adult patient is unable to give consent, an immediate family member can do so for emergency procedures. When no parent or family member can be contacted, telephone consents are usually acceptable if witnessed by at least one other uninvolved health-care provider.

Emergency Consent

If unable to obtain patient, guardian, or family consent, emergency care can be rendered only if:

- The care is necessary to prevent loss of “life or limb” or severe disability, and
- The above is documented by the dentist and at least one other doctor.

Non-emergency care should be deferred. As a last resort, the doctor can obtain “administrative consent” through the hospital administrator on duty for that facility. One should become familiar with individual regional laws and hospital rules concerning such situations.

Follow-Up

It is incumbent on the doctor who renders emergency services to provide patients with information regarding the need for and access to follow-up care. Preferably, this information is provided in written form and documented in the medical record.

Outpatient vs. Inpatient Care

Generally speaking, most dental emergencies can be treated in an outpatient environment. However, oral and maxillofacial surgeons, in particular, are commonly faced with situations in which admission of the patient is warranted.

General Indications for Admission to the Hospital

- Patients with severe, traumatic injuries requiring skilled nursing care, such as a concurrent head injury
- Patients who require parenteral antibiotics or analgesics
- Patients who require parenteral hydration or feeding
- Patients who require emergency surgery
- Patients unable to care for themselves under the current circumstances, including children whose parents are deemed a risk
- Patients with the need for airway management
- Patients whose medical condition warrants specialized medical care, concurrent with the dental problem, such as a fragile diabetic with an odontogenic infection or cancer patient on chemotherapy

Emergency Department Medical Records

Documentation

Nowhere is the mandate for accurate and complete documentation more important than in emergency care.

- Many of these patients will be seen for definitive follow-up care by non-dentists.
- Dental treatment and terminology is often poorly understood by physicians and nurses—hence the need to write “bleeding in maxillary right first molar region” and not “bleeding from tooth #3.”
- Some emergency department cases can eventually involve legal proceedings or litigation. Therefore, the maintenance of objective, accurate, detailed records is paramount to the ability to recollect prior events.

Medical Records

The medical records used for emergency care are similar to those used elsewhere in the hospital (e.g., the history and physical examination and the progress notes). These notes are presented in detail in Chapters 2 and 4 but some modifications specific to emergency records are outlined below.

Consultation Note

The consultation note is for a patient under the care of another provider who requests a dental opinion regarding a specific problem. Primary care responsibilities remain with the requesting provider and all orders should be confirmed with that provider prior to institution, unless responsibility has been transferred to the dentist. A consult note should be thorough yet concise and include the following information:

- Purpose: The purpose of the consultation should be outlined prior to the definitive assessment.
- History of present illness (HPI): A detailed history of the current dental problem relating to the consult request. If other conditions exist that brought the patient to the ED and are being treated by the primary provider (e.g., long bone injuries accompanying a mandible fracture from a motor vehicle accident), these too should be briefly described.
- Past medical history (PMH): A listing of the pertinent positive and negative findings from the patient’s past and current medical history. Any positive review of systems findings are generally included in this section for consultation notes. All positive findings should include a brief discussion describing the current status of the medical condition.
- Current medications (MED): A list of the patient’s medications with the route of administration, dose, and interval schedule. If unclear, a family member, the pharmacist, or the doctor who wrote the prescription(s) should be contacted.
- Allergies (ALL): A list of the patient’s known drug allergies and the particular response seen from previous administration (e.g., hives, itching, gastrointestinal upset).
- Physical examination (PE): This section should include an appropriate head and neck examination and a thorough oral examination. In addition, any other examination pertinent to the consultation request should also be performed (e.g., a neurologic examination for a patient with facial injuries). Examination results should be detailed, especially in the specific area mentioned for examination in the consult request.

- Radiographic and laboratory examination: Necessary radiographs and/or laboratory tests should be obtained and interpreted. Many radiographs (e.g., periapicals, panoramic) are interpreted by the dental consultant, not by a radiologist or the primary provider, and should, therefore, be read comprehensively, not just for the specific complaint. All pertinent laboratory data (e.g., CBC, platelet count, PT/INR, PTT) should be listed and interpreted as well.
- Assessment: This is a line-by-line listing of all the positive findings, followed by a brief discussion of the current status and its effect on the patient's care.
- Recommendations and treatment: These are recommendations regarding diagnosis and appropriate treatment based on the assessment. Recommendations should be thorough and specific, indicating particular therapies, drugs, and dosages. No treatment should be performed without the consent of the primary provider. If any treatment is performed, it should be clearly noted in this section, along with any anesthesia used.
- Disposition or discharge information: This is a listing of instructions given to the patient, medications prescribed (with primary provider's permission), follow-up appointments, or other plans.

Primary Care Notes

In some circumstances, the dentist might be the only clinician to see the patient. In these cases, it is even more imperative to consider the patient's overall medical condition and not just the head and neck region. For example, patients with facial injuries might have concomitant cervical or intracranial injuries that often cannot be appreciated by the triage staff. Another example is oral bleeding. Although there are many local reasons for oral bleeding, the dentist is obliged to consider systemic sources or coagulopathies and order the appropriate tests to make the correct diagnosis, and then obtain appropriate medical consultation. It is important to write complete notes that more closely approximate an admission note. Orofacial trauma might be a result of syncope in the elderly (a common but significant and diagnostically complex syndrome with potential cardiovascular, neurologic, endocrinologic, visual, vestibular, and neuromotor implications), or abuse in a child or a dependent older individual. These situations dictate a medical and/or social services consult if abuse is suspected.

Primary care notes differ from consult notes as follows:

- Chief complaint (CC): The chief complaint should be brief (one sentence or less) and recorded in the patient's words.
- HPI: The history must be comprehensive and include all information relating to the present condition, not just that affecting the head and neck. Traumatic dental or facial injuries, for example, should be detailed as to the time, mechanism, and severity of the injury as well as previous traumatic episodes. Specific questions should be directed at ascertaining the likelihood of other systemic injuries (e.g., chest, abdominal, cervical, or intracranial).
- Social history (SH): A social history containing information germane to the problem should be included. For instance, a history of substance use may be important for the evaluation of a potentially cancerous lesion.
- Family history (FH): A family history may be helpful to rule out potentially inherited problems.

- The physical examination, while certainly emphasizing the head and neck findings, should nevertheless include a basic examination of any other bodily system that is pertinent to the HPI. Positive findings should indicate the need for appropriate medical consultation.
- Radiology/labs: Appropriate films (e.g., C-spine) and lab data should be obtained (when indicated by the history or PE) to rule out concomitant injuries and/or possible systemic factors, as well as to diagnose the acute dental or facial injuries.
- Assessment/plan (A/P): This should reflect the patient's overall condition including the oral findings and any others. When nondental items are listed, specific medical consultation should be ordered and noted in the medical record.
- Admission notes: These should consist of the primary care note and the following:
 - Indication for admission
 - Name of the attending dentist
 - Principal diagnosis
 - Place to be admitted
 - Condition of the patient
 - Immediate treatment plan

Consultation Request Notes

Written consultation requests to another service or doctor should be instituted whenever the dentist feels that it is necessary for the comprehensive and appropriate care of the patient. The best practitioners are the ones who know when to ask for assistance in the best interest of the patient. When in doubt, obtain a consult. A consult request should include the following:

- A brief summary of the HPI and treatment to date
- Any pertinent medical history, physical findings, and radiographic or laboratory data
- A detailed and specific explanation of why the consult is being ordered and what information is desired from the consultant. If any necessary treatment by the consultant is desired, this should also be indicated in the note
- Direct verbal communication between dentist and consulted physician is encouraged whenever possible.

Follow-Up Notes

Follow-up notes can be written in the "SOAP" format as follows:

- Subjective: This includes the patient's chief complaint if there is one, or any comments the patient has regarding the condition, past treatment, and so on.
- Objective: This includes the physical examination and the radiographic and laboratory data, if ordered.
- Assessment: This is a summary of the patient's condition.
- Plan: The plan is the consideration for the future management of the patient and any appointments scheduled.

Intra-Oral Urgencies

Odontogenic Pain

General Principles

Pain of odontogenic origin is the most common dental emergency seen in the ED. Although the etiology and management are usually straightforward, other more serious conditions can present with a similar clinical presentation. Misdiagnosis can have serious ramifications and it is incumbent upon the practitioner to perform a complete diagnostic work-up that includes the following:

- **History:** The history of pain should include duration, location, description (character and intensity on a scale of 1 to 10) and what exacerbates and relieves the pain. Note the medications taken, dose and duration, and how effective or ineffective they have proved to be. Any previous treatment or similar history should be noted.
- **Physical examination:** The patient should be examined for any tooth that is sensitive to percussion, pressure on biting/mastication, and palpation, as well as for mobility, periodontal pocketing, adjacent soft tissue swelling, caries, fractures, integrity of existing restorations, and pulp vitality.
- **Radiographic and laboratory examination:** Intra-oral and/or panoramic radiographs should be obtained and examined for caries, periodontal disease and periapical changes, fractures, or other pathology. Occlusal views (for the anterior segment of the maxilla or mandible) may be useful for children. A Water's view or computerized tomographic scan (CT scan) might be necessary to examine for sinus disease. Reviewing laboratory values such as the white blood cell count (WBC) or a complete blood count (CBC) and obtaining a Grams stain along with anaerobic and aerobic cultures are often useful when an infection exists or is suspected.

Management of Specific Intra-Oral Urgencies

Each individual institution and practice has varying forms of equipment available to manage emergent and urgent problems. While some emergency room facilities may provide access to a handpiece or rotary instrumentation, others may not. Thus, an initial emergency department visit may require follow-up at the appropriate outpatient facility with the proper instrumentation. The overall management is discussed in the sections to follow.

Hypersensitivity of Dentin or Cementum

- **History:** Positive for localized sensitivity to cold, sweets, acids, tooth brushing, or metal instrument
- **Examination:** Usually demonstrates localized areas of exposed cementum or dentin, with or without overlying plaque
- **Tests:** May be sensitive to air blast or metal instrument (explorer) at gingival level of tooth surface. Hyper- or traumatic occlusion should be ruled out

- Treatment: Use of fluoride gel or commercial dentin desensitizers following thorough cleaning can help to desensitize.
- Prognosis: Symptoms should decrease within days and eventually disappear. The area must be kept clean. Restoration might be required.

Pulpal Hyperemia

- History: Transient thermal or biting sensitivity. Often a history of recent restorative treatment
- Examination: Examine patient for faulty restoration, caries, hyper- or traumatic occlusion, or enamel or tooth fracture (“cracked tooth” syndrome)
- Tests: May be sensitive to air blast or cold. Electric pulp test (EPT) positive at low level or normal
- Prognosis: Usually reversible with appropriate treatment
- Treatment: If possible, the source (e.g., high restoration) should be removed. If indicated, a sedative restoration can be useful. If due to deep caries and when pulp pathology is believed to be reversible (e.g., no periapical pathology, no lingering spontaneous pain that might be worse overnight and stimulated pain of short duration only) an indirect pulp cap may be used

Acute Pulpitis (Early)

- History: Spontaneous, intermittent, sharp, spasmodic pain and cold sensitivity; pain of longer duration than simple hyperemia but not continuous; sensitivity to hot and/or cold foods/drinks (e.g., coffee/tea and/or ice cream)
- Examination: Usually reveals identifiable source of pulpitis (e.g., caries, deep restoration, fractured restoration, or clinical crown). Radiograph might not demonstrate periapical radiolucency
- Tests: Positive electric pulp test at low level. Heat and/or cold may excite. Tooth may be percussion sensitive
- Prognosis: Probably not reversible
- Treatment: If reversible pulpitis and if all infected caries is removed without exposure, use sedative filling. If carious exposure, then:
 - Permanent tooth (open apex): Calcium hydroxide or mineral trioxide aggregate (MTA) pulpotomy
 - Permanent tooth (closed apex): Pulpectomy
 - Primary tooth: Pulpotomy, pulpectomy, or extraction as an alternative

Note: A given tooth might have overlapping symptoms from more than one cause; for example, a molar with pulpal hyperemia in a distal canal and necrotic mesial canals (from mesial caries) might give misleading electric pulp test (EPT) results and the history might suggest symptoms of both a reversible and irreversible situation.

Acute Suppurative Pulpitis (Later Stage)

- History: Spontaneous, intense, sharp pain lasting longer periods of time. Heat sensitive, cold may soothe

- Examination: Look for a source of pulpitis (e.g., caries, fractured tooth, or restoration), which might have referred pain and/or may be of periodontal origin. A radiograph usually shows widening of the periodontal ligament at the apex, or periapical lucency. Regional—particularly submandibular—tender lymphadenopathy on palpation
- Tests: Electric pulp test unreliable. Usually percussion and/or heat sensitive
- Prognosis: Irreversible
- Treatment: Extraction or root canal therapy

Non-Vital Pulp with Periapical Inflammation

- History: Chronic, unstimulated pain; sensitive to biting. May report a recent history of cold sensitivity with a tooth. Percussion sensitivity. Pain may be referred. In severe cases, patient may sip cold water to relieve pain
- Examination: Identify source of pulpal pathology. Regional, particularly submandibular, tender lymphadenopathy on palpation
- Tests: No response to heat, cold, or electric pulp test. Positive percussion sensitivity
- Treatment: Pulpectomy and eventual root canal therapy or extraction. If regional or systemic infection exists, antibiotic therapy may be indicated with enteral penicillin, amoxicillin, or for penicillin-allergic patients, clindamycin preferred (Appendix 12, Table A12-4)

Acute Periapical Disease (Alveolar Abscess)

- History: Exquisite, localized pain, throbbing. May have history of facial swelling and/or fever
- Examination: An identifiable source of pulpal disease is almost always found. May be tender on direct finger palpation of the vestibule or may see swelling in the vestibule (that can be fluctuant and painful), inflammation, and possibly fever and/or regional lymphadenopathy
- Tests: Positive percussion sensitivity. No response to thermal or electrical stimulation. Radiographic evidence of periapical radiolucency
- Treatment: Enteral antibiotics for less severe infections (penicillin, amoxicillin, or for penicillin-allergic patients, clindamycin) (Appendix 12, Table A12-4); analgesics; establishment of adequate drainage either through the pulp chamber, by incision and drainage of the vestibule, or by extraction. If drainage does not require opening fascial planes then extraction should be done as the initial therapy. When fascial planes will be violated by an extraction (e.g., a “surgical extraction”), the patient should initially be placed on antibiotics, an incision and drainage (I and D) done, and the extraction performed when less acute, usually in one to two days.

Maxillary Sinusitis with Referred Pain to Teeth

- History: Unilateral or bilateral pain in maxillary posterior teeth, usually difficult to localize to one tooth and often involves premolars and molars with root apices adjacent to sinus. The patient may complain that “all the teeth hurt” and also

of increasing pain upon bending over and/or a “fullness” about the midface. Pain may occur several weeks following resolution of flu or upper respiratory infection. Otherwise, the patient presents with typical sinus symptoms

- Examination: Primary dental source should be ruled out. There is discomfort when digital pressure is placed infraorbitally on the sinus wall. Transillumination of the sinus by placing a fiberoptic light against the hard palate may reveal an increased opacity on the affected side
- Tests: Percussion sensitivity of multiple maxillary teeth. Sinus (Water’s or panoramic) radiographs demonstrate increased radiopacity or an air-fluid level. If CT is available it is unsurpassed in demonstrating an “air/fluid” level. Electric pulp testing should be normal
- Treatment: With history of sinus infection, pain, drainage, blockage, or dental sensitivity that does not improve in 24 to 48 hours, refer to an appropriate specialist, most often an otorhinolaryngologist
- Prognosis: Excellent. Symptoms usually resolve within several days if due to sinus rather than odontogenic source

Coronal Fracture (“Fractured/Cracked Tooth Syndrome”)

- History: Sharp, intermittent, localized pain, usually with chewing (releasing). May have history of trauma to tooth/jaw, recent restoration, or chewing ice
- Examination: Pain elicited by biting pressure, or, classically, with release after biting on a tongue depressor. Fracture is usually evident upon close inspection of a dry tooth with mirror and good lighting. Often occurs on marginal ridges at contact point or lingual/occlusal adjacent to overextended restoration groove. May run over cusp tip or be circumferential
- Treatment: Cusp capping restoration is often necessary. Intermediate restoration material (IRM), if necessary using an orthodontic band to stabilize, followed by removal or reduction of the fractured area for several weeks to allow for resolution of symptoms. Possible endodontic therapy or extraction if fracture involves furcation or extends below cemento-enamel junction

Dental Pain of Other Origin Occasionally, pain that appears to be of odontogenic origin actually originates from other sources. Possibilities for such pain include referral from a myofascial source, myocardial ischemia, otalgia, sickle-cell crisis, and adverse effects of medications such as vincristine or vinblastine. These sources must be considered when no odontogenic source is identified.

Soft Tissue Lesions

Periodontal Abscess

- Etiology: Acute exacerbation of chronic periodontitis; unable to drain through gingival crevice. Localized plaque and/or calculus deep in gingival crevice. Foreign body in the gingival crevice. Endodontic abscess. Root fracture
- Diagnosis: Progressive, localized pain and deep isolated pocket formation. Gingival tissues become red, swollen, and painful with possible purulence from

gingival crevice. Tooth mobility. Foreign body may be found in crevice. Non-vital pulp possible. Dentification of root fracture with deep pocket

- Treatment: Local anesthesia; irrigation with saline or chlorhexadine if indicated. Ultrasonic debridement, scaling, and root planing. Incision and drainage if fluctuant, with or without a Penrose drain, to obtain drainage through gingival crevice. Enteral antibiotic coverage in presence of systemic signs or symptoms (penicillin, amoxicillin, or for penicillin-allergic patients, clindamycin) (Appendix 12, Table A12-4). Close periodontal follow-up

Necrotizing Ulcerative Gingivitis or Periodontitis

- Etiology: Necrotizing ulcerative gingivitis (NUG) and necrotizing ulcerative periodontitis (NUP) are painful, noncontagious bacterial infections of the papillary and marginal gingiva and alveolar bone, respectively. They are usually opportunistic infections of mixed anaerobic flora, but anaerobic spirochetes and fusiforms commonly predominate. Commonly associated with mild local or systemic immunosuppression that accompanies periods of emotional stress, fatigue, malnutrition, poor hygiene, pre-existing gingivitis, and smoking. The periodontitis form has been associated with the systemic immunosuppression resulting from HIV infection
- Diagnosis: Bleeding, necrosis, and blunting of the interdental papillary gingiva with pseudomembrane formation. Gingival pain, usually severe, and halitosis. Fever, malaise, cervical lymphadenopathy. Periodontitis form also is associated with periodontal ligament attachment loss and alveolar bone destruction
- Treatment: Saline, or chlorhexadine if desired, irrigation using a large syringe and plastic IV catheter. Gross mechanical debridement (ultrasonic or, if possible, scaling and curettage) using local anesthesia. Oral hygiene, dietary and stress counseling. Enteral antibiotic therapy when systemic signs are present (clindamycin or metronidazole) (Appendix 12, Table A12-4). Prompt follow-up appointment for oral hygiene. Analgesic medication as needed. Consider HIV testing when periodontitis form is present or if index of suspicion is high (Appendix 18)

Herpes Simplex Infection

- Etiology: Infection caused by the herpes simplex type 1 (HSV-1) or herpes virus type 1 (HHV-1) virus or, less commonly, by the herpes simplex type 2 (HSV-2) or HHV-2 virus, which more commonly causes genital lesions. Approximately 80% of the adult population have antibodies following primary infection. The latent virus persists in the trigeminal nerve ganglion innervating the affected area, where it may be reactivated to reappear later, under a variety of conditions, as a recurrent herpes infection

Primary Herpetic Gingivostomatitis

- Diagnosis: Usually seen in children, or young adults not previously exposed to virus. May be subclinical or quite severe. Prodrome of fever, irritability, headache,

dysphagia, and regional lymphadenopathy. A few days later, the patient reports painful gingivitis followed by multiple yellowish, fluid-filled vesicles on the lips, tongue, buccal mucosa, and hard palate, which rapidly rupture to form ragged, extremely painful ulcers. These ulcers last seven to 14 days, crust over, and heal without scarring. Diagnosis is usually clinical, although the virus can be cultured from fluid of an intact vesicle. Must be differentiated from erythema multiforme

Recurrent Herpes

- **Diagnosis:** Usually seen as an attenuated form of primary infection. Reactivated by trauma, emotional stress, fatigue, menstruation, pregnancy, respiratory infections, or prolonged exposure to sunlight. Prodromal symptoms include burning, tingling, or pain at the site where the recurrent lesion will appear. May see one or multiple small vesicles, which quickly ulcerate and coalesce, leaving a small red area with or without an erythematous halo and which heal without scarring in seven to 14 days

Treatment

- **Primary herpes:** Adequate hydration and nutrition. In severe cases and with young children, this may require intravenous rehydration and dietary supplementation. Systemic and topical analgesics as required (e.g., viscous lidocaine 2% swished and expectorated prior to meals, not indicated in children who cannot expectorate, usually under seven years old). Avoid aspirin in young patients. In immunocompromised patients with primary herpetic stomatitis or mucocutaneous herpes simplex infection, consider enteral or intravenous acyclovir (Appendix 12, Table A12-4)
- **Herpes labialis:** May benefit symptomatically from topical acyclovir or penciclovir but only if given during the prodromal stage. Patients with frequent, recurrent bouts of herpes labialis can benefit from oral acyclovir given at the first sign of recurrence.

Aphthous Ulcers

- **Etiology:** The etiology of aphthous ulcers is not clearly understood but they appear to be autoimmune with many possible contributory mechanisms, including psychic, allergic, microbial, traumatic, endocrine, and heredity. Despite some clinical similarities, aphthae are separate and distinct entities from recurrent herpetic lesions
- **Diagnosis:** Can occur at any age. Originates as an erythematous macule or papule that undergoes central blanching, necrosis, and eventual ulceration. Shallow ulcers range in size from 0.5 (minor aphthae) to 3 cm (major aphthae). Demonstrates gray or yellow necrotic center and an erythematous halo. Although usually singular, they can occur in small groups (herpetiform type) that later become a single or a few confluent ulcers. Almost always occur on non-keratinized, unattached tissue (e.g., vestibule, ventral tongue, labial mucosa, floor of mouth). Pain is moderate to severe

- Treatment: Generally supportive in nature, as the lesions usually disappear in seven to 14 days. Particularly severe aphthae and major aphthae might require additional measures. This should include adequate hydration and nutrition. Although there is no proven treatment for aphthae, a number of clinical therapies have been advocated for minimizing pain or shortening the life of the ulcer, including:
 - Topical agents such as tetracycline or chlorhexidine mouthwashes; protective topical dressings such as hydroxypropyl cellulose or Orabase® used PRN
 - Topical steroids such as tramcinolone (e.g., Kenalog® in Orabase®) or fluocinonide (e.g., Lidex®) ointment twice a day
 - Analgesics such as benzocaine in Orabase® applied PRN or benzydamine rinse, if available. (Appendix 12, Table A12-4)

Burns

- Etiology:
 - Chemical: most commonly seen with topically used salicylates (e.g., aspirin), which cause coagulation necrosis. Iatrogenic chemical burns can result from common materials such as eugenol. Occasionally seen with accidental or intentional ingestion of caustic materials (e.g., lye or gasoline). For that reason, the trajectory of the chemical pathway must be assessed to rule out or confirm concomitant pharyngeal and/or esophageal burns
 - Physical: Can occur in a child biting an electrical cord or a burn from a dental handpiece. Also common from hot food (e.g., “pizza palate”). Electrical burns are arch burns and as such result in tissue damage well beyond what is initially recognized during the hours immediately after the injury

For extensive chemical, thermal, or electrical burns, referral to the appropriate specialist should be considered.

- Diagnosis: Mild burns (first degree) manifest as erythema. More severe burns are mixed red–white areas, or just white areas, indicating tissue necrosis. Electrical wire burns usually occur at the commissures of the mouth. Can cause severe scarring and contraction if left to heal without treatment. Can be complicated by delayed hemorrhage from the facial/labial arteries
- Treatment: Most mild burns require no treatment and heal spontaneously, although adequate hydration and nutrition must be assured. More severe burns may require debridement of necrotic tissue, which can be accomplished with or without local anesthesia as warranted. Also saline rinses and good oral hygiene. Topical (e.g., viscous lidocaine) or systemic analgesics often necessary. For electrical burns, the patient should be referred immediately to a pediatric dentist for splint construction to prevent contracture of the commissures subsequent to healing and fibrous scarring. In the case of swallowed caustics refer for endoscopy

Human Bites

- Human bites are considered to be “crush” injuries that are contaminated with numerous microorganisms. The usual organisms are *Staphylococcus aureus*,

Streptococcus species, and *Eikenella corrodens*. Anaerobic bacteria such as *Bacteroides*, *Prevotella*, *Fusobacteria* species, and others are common. Gram-negative species are less common. *E. corrodens* is especially important because of its unusual antibiotic sensitivity—it is sensitive to penicillin and ampicillin but resistant to semisynthetic penicillins and first-generation cephalosporins.

- **Management:** Because they are contaminated, crush injuries, all bites should receive appropriate tetanus prophylaxis. Treatment then involves thorough cleansing, copious irrigation, debridement, and the appropriate use of prophylactic antibiotics. Bites often occur in daycare settings. Child abuse should be suspected in bites with a questionable history. Human bites to the face seen within 24 hours can be primarily sutured after appropriate cleansing and debridement. Prophylactic antibiotics should be given. Hand bites require special treatment because of the possibility of unrecognized penetrating injury to a joint. Human bite injuries to the hand must be irrigated thoroughly and an appropriate wound dressing placed. Close follow-up is essential. There is a high incidence of infection of the soft tissue and joint space (metacarpophalangeal) and referral to the appropriate specialist should be considered. Treatment recommendations for bites other than the hand and face are individualized but always include thorough debridement and irrigation and generally prophylactic antibiotics. Broad-spectrum, second-generation cephalosporins have been recommended for human bites, but amoxicillin plus clavulanic acid is an excellent choice (Appendix 12, Table A12-4). For bite injuries that result in avulsion, referral to the appropriate specialist should be considered.

Postoperative Emergencies

Postoperative complications managed in the emergency department sometimes pose difficulties for the treating dentist because he or she may not be the doctor who has performed the initial procedure and thus little might be known about the difficulty of the original procedure or patient management modalities.

- Acquire a complete history of the present illness, including as many details about the original procedure as the patient can remember. The medical records should be obtained, if possible.
- Conduct a thorough physical examination of the involved site.
- Contact the doctor who performed the original surgery, if possible.

Bleeding

Bleeding can be a particularly frightening complication to the patient or family. Any amount of blood (as little as 5 or 10 cc) can be considered heavy bleeding by the patient when it originates from the mouth or involves the patient's clothing. Blood mixes with saliva in the mouth, increasing the apparent volume of "blood" present (one drop of blood mixing with ten drops of saliva appears as a dozen drops of

blood). Bleeding is most commonly due to local factors and is rarely a manifestation of an underlying systemic problem.

Bleeding from an Extraction or Bony Surgery Site

- Etiology: Loss of organized blood clot from smoking, excessive spitting and rinsing, or using a straw within 24 hours of surgery; salivary plasminogens; reopening of a vessel that was tamponaded or vasoconstricted at the time of surgery; loss of one or more sutures; excessive highly vascular granulation tissue in the socket (as is often seen in severe periodontal disease); acquired coagulopathy, most commonly drug related (e.g., warfarin or substances containing aspirin or alcohol); less frequently, an inherited coagulopathy
- Identify the site of origin: Small bleeding vessel within the bony wall of the socket; brisk bleeding from the apical area indicating possible arterial damage, especially if pulsatile; bleeding emanating from the soft tissue around the socket; bleeding from granulation tissue left in the socket; generalized oozing from all areas
- Management:
 - Thorough history and physical examination. Particular emphasis should be placed on current medications and herbal supplements (patients are often unaware of medications and herbal supplements that may impair coagulation). Also inquire about compliance with postoperative instructions; take care phrasing these questions (e.g., “Have you had to spit much blood to keep from swallowing it?”)
 - Ensure the appropriate suction equipment (with a small-diameter stiff suction tip) and lighting (preferably a headlight) is available
 - Examine for obvious bleeding vessels in or around the site. If visualized, electrically coagulate or ligate with resorbable suture under local anesthesia
 - If the bleeding is noted to be brisk or arterial (pulsatile) in nature, inject local anesthesia with a vasoconstrictor, debride, irrigate the socket, and examine closely for specific areas of bleeding. Small bone bleeders may be crushed with a metal instrument or stopped with a small amount of bone wax. Apical or non-isolatable bleeds should be packed with Surgicel®, Avitene™, or Gelfoam®.

Following this, or if bleeding is coming from the soft tissues, use inter-papillary or figure-of-eight “hemorrhagic” sutures and reinstitute pressure

- Blood “liver” clots may form, especially in the setting of thrombocytopenia. These gelatinous clots need to be removed prior to controlling bleeding because otherwise their movement will likely promote further oozing
- If no obvious vessels are seen, initial management should always be with tamponade (direct pressure). This is accomplished by biting on gauze, under observation, for 20 minutes. If this fails, a gauze impregnated with liquid topical thrombin or 5% tranexamic acid can be tried for an additional 20 minutes
- When local causes have been ruled out, appropriate laboratory tests should be ordered. This includes a complete (full) blood count (CBC), (FBC) with

differential and platelet count, prothrombin time (PT), and international normalized ratio (INR), and partial thromboplastin time (APTT). If abnormalities are detected, medical consultation is indicated

- Instructions: When the bleeding is controlled, the patient should be given careful verbal and written instructions to decrease risk of recurrence

Bleeding from the Gingiva

- Etiology: Severe gingival or periodontal infection, including acute necrotizing ulcerative gingivitis, linear gingival erythema, and primary herpes; trauma; intrinsic (e.g., hemophilia) or extrinsic (medications) coagulopathy; other systemic cause (e.g., acute leukemia)
- Diagnosis: History and physical examination should differentiate local from systemic sources. When indicated, obtain appropriate blood tests
- Management: Injection of local anesthesia with vasoconstrictor into the area; gauze pressure; removal of granulation tissue in periodontal conditions; repair of traumatic injuries; medical consultation for coagulopathies

Bleeding from Postoperative Soft-Tissue Incisions

- Etiology: Wound margin bleeder; dead-space hematoma; arterial or venous bleeding within the wound itself
- Diagnosis: Examine and palpate the surgical site. Gradual discoloration and swelling at the site usually indicates an underlying hematoma. Brisk, bright red blood usually indicates arterial bleeding. This may be immediate or delayed (from loss of a suture or vascular invasion)
- Management: Wound margin bleeders and slow, venous bleeders can usually be stopped with direct pressure or a pressure bandage, but might require additional sutures. Deep arterial bleeding mandates opening the wound; explore for vessel to be coagulated or ligated. Hematomas should be evacuated by opening a small area of the incision, probing with a hemostat until the hematoma is found, and expressing the blood. Direct pressure and a pressure bandage should be used to prevent secondary hematoma formation. If bleeding persists, the wound should be explored.

Postextraction Pain

- Etiology: Normal pain due to inflammation; alveolar osteitis (“dry socket”) due to loss of the blood clot within the socket and exposure of sensory nerve endings within the socket; localized infection (periostitis or alveolar infection); localized tenderness due to loose bone fragment; lingual plate dehiscence
- Diagnosis: A careful review of the history usually leads to a diagnosis:
 - Normal pain: Begins soon after surgery and remains constant or improves slowly with time (varies from patient to patient)

- Alveolar osteitis: Pain becomes acute at two days after extraction. There is a “metallic” taste in the mouth. The pain is severe enough to make sleep impossible. The frequency is 90% for the mandible and only 10% for the maxilla. Often radiates to the ipsilateral ear. The examination will only show loss of the clot from the socket. A foul odor is common
- Localized infection: This usually presents a few days to a few weeks after surgery. Physical examination reveals signs of inflammation and infection. May see purulence and there might be an elevated white blood cell count and fever. Palpation of the area is acutely painful, especially with periostitis
- Fractured buccal plate: Palpation over socket, usually buccal, reveals tenderness and possibly crepitus
- Lingual plate dehiscence: Days to weeks after the removal of mandibular second or third molars, a sharp protruding bone will irritate the tongue. It can be visualized during the examination
- Management:
 - Normal pain: Reassurance, observation, and analgesics as indicated
 - Alveolar osteitis: Gentle irrigation of socket to remove debris and placement of a sedative dressing containing eugenol. This should be left for four to five days. Replacement during that period should be carried out every other day, or at any time the patient feels the pain return. Analgesics should be prescribed
 - Localized infection: Periostitis is usually treatable with antibiotic therapy (e.g., penicillin) (Appendix 12, Table A12-4). Socket infections are treated with antibiotics and incision and drainage as necessary
 - For fractured bone: Remove suture, identify and remove bone fragment, irrigate and resuture
 - Lingual plate dehiscence: The process is self limiting. When the lingual plate no longer has a blood supply from the periosteum, it will become dislodged. It may feel like a “corn flake” on the tongue when dislodged. A hemostat may be used to assist the debridement. Open surgical management is ill advised due to the proximity to the lingual nerve.

Nausea and Vomiting

- Etiology: Swallowed blood; post-anesthetic effects if IV sedation or general anesthesia used; drug side effects (antibiotics, analgesics)
- Diagnosis: Examine for bleeding; determine type of anesthesia used for surgery; review medications
- Management: Control bleeding if present. If medication-induced, discontinue or change to medications less associated with nausea (e.g., acetaminophen [paracetamol] instead of codeine or ibuprofen). If no change or if anesthetic related, consider an antiemetic given rectally, IV, or IM. For adults, examples include: promethazine, prochlorperazine, trimethobenzamide, ondansetron (Appendix 12, Table A12-4)

Odontogenic Infections

General Concepts

Pain from odontogenic infection is the most common problem seen by dentists in the emergency department. In fact, because of their ubiquitous nature, pain, infection, and swelling of the face and neck region should generally be assumed to be of odontogenic origin until proven otherwise. When addressed early, complications are rare and minor. When allowed to progress when a particularly virulent organism is involved and/or when the host is immunocompromised, odontogenic infections can lead to serious morbidity or even death. The very first consideration in the management of odontogenic infections is the assessment and maintenance of the airway.

Diagnosis of Infection

History

The patient will commonly have a history of toothache at some point in the past, although a lifetime of pulpal regression might spare people of advanced age this particular antecedent to abscess. Swelling will usually have begun only recently and exacerbated quickly. The pain and swelling might have improved and then worsened again as the infection traverses different fascial spaces. The history should include the duration of the infection as well as any previous treatment and its response.

Physical Examination

Vital Signs

The inclusion of a temperature, blood pressure, pulse rate, and respiratory rate are helpful in the overall assessment. One degree Fahrenheit above a normal temperature raises the pulse rate 10 beats per minute and the respiratory rate by one breath per minute. These features help direct patient management.

Swelling

- **Fluctuant:** Fluid-filled area indicating abscess formation. These tend to be chronic (days to a week) in nature
- **Non-fluctuant:** Some organisms (e.g., streptococci) tend to cause spreading infections rather than abscesses. This is seen as a cellulitis. These tend to be acute (hours to days) in nature
- **Reactive edema:** The tissue surrounding the area of infection may develop moderate to severe secondary edema. This is often seen in the periorbital area when associated with maxillary dental infections. Can be differentiated clinically from infection by its soft, non-fluctuant, non-tender nature

Erythema

Localized erythema of the skin or mucosa will appear adjacent to the infection.

Pain

- Pain to palpation: An area of infection is usually quite tender. Decreasing tenderness is often indicative of the effectiveness of therapy
- Trismus: As infections impinge on the muscles of mastication, trismus will become evident
- Source: The source of an odontogenic infection is usually easily identified as a tooth with carious exposure of the pulp or severe periodontal condition. When an obvious source cannot be isolated, nonodontogenic sources must be considered

Drainage

In some cases, spontaneous purulent drainage may be evident. This is often accompanied by bad odor and taste.

Lymphadenopathy

Tender, palpable, freely mobile, new onset lymph nodes may be present along the chain draining the infected site.

- Radiographic data: Clinically evident sources should always be confirmed with radiographic data. This could include a panoramic, periapical, or occlusal radiograph (useful for children when other films are not possible), or lateral oblique views in less cooperative patients, particularly those with a learning disability. Computed tomography is the gold standard for the assessment of severe infections (Figure 5.1). Cone-beam technology is now available and is unsurpassed in demonstrating the etiology, assessing the soft tissue affected, and directing surgical management

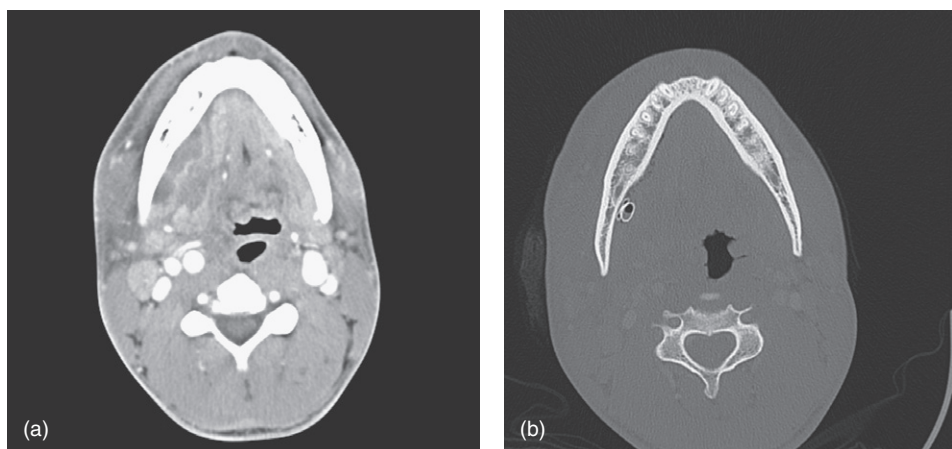


Figure 5.1. (a) Noted in this axial view of a computed axial tomograph is a right submandibular abscess, visualized adjacent to the mandible on the right side of the image (the patient is viewed from the bottom up). Note that the airway is displaced to the patient's left. (b) In the postoperative scan, a Penrose drain is visualized, as the round opaque rings, where the abscess was previously located.

Medical Management of Odontogenic Infections

Systemic Medical Evaluation

Infections of odontogenic origin are usually managed before the patient demonstrates systemic manifestations. The presence of fever, chills, shaking and malaise, or of confusion and clouded consciousness (“delirium”) in an elderly person, indicates that complete systemic evaluation is warranted. In addition, the spread of infection is related to the virulence of the organism and the state of the host’s immune system. As such, patients with rapidly advancing odontogenic infections should be thoroughly evaluated for evidence of diminished immune competence.

Consider referral to and management by an appropriate specialist if:

- Rapid progression
- Difficulty breathing
- Difficulty swallowing
- Fascial space involvement
- Elevated temperature (above 101°F) (38.3°C)
- Severe trismus (maximal incisal opening less than 10.0 mm)
- Toxic appearance
- Compromised host

Indications for Hospitalization

- Systemic involvement: Fever, dehydration with orthostasis requiring parenteral fluids and nutrition
- Evidence of spreading tissue necrosis or cellulitis involving critical areas such as periorbital region and areas with potential airway compromise (sublingual, submandibular, and/or parapharyngeal spaces)
- Immune system compromise: HIV, diabetes, steroid therapy, alcoholism, cancer chemotherapy
- Need for intravenous antibiotics
- Infections requiring special treatment: Fungal infections, osteomyelitis, actinomycosis
- Patients unable to manage their infections at home due to disability
- Children who cannot, will not, or have not eaten, or who have unreliable parents/guardians

Nutrition

Patients with infection are often unable to maintain their dietary and fluid intake and should receive IV maintenance fluids. Patients unable to eat for longer than 48 hours should be considered for nasogastric feeding.

Culture and Sensitivity (C&S) Testing

In all but the most minor of fluctuant odontogenic infections (and these as well if they are resistant to initial treatment), consider sending cultures for a Gram stain, as well as for anaerobic and aerobic cultures. The decision for sensitivity testing depends upon the severity of the infection. This may be accomplished by:

- Cleansing the area with an antimicrobial skin or mucosa preparation agent, such as povidine iodine solution
- Aspiration: A 3- to 10-cc syringe is attached to a 14- to 20-gauge needle, which is then inserted through uncompromised and cleansed tissue into the area of fluctuance. This may be used for both aerobic and anaerobic culturing. The aspirate can be placed directly into the anaerobic and aerobic culture tubes
- A drop of the aspirate should be placed on a glass microscope slide for Grams stain, or a request made of the laboratory along with the submission of anaerobic and aerobic cultures
- After incision the purulent specimen that drains can be collected with the sterile swab that comes with the anaerobic and aerobic culture tubes

Principles of Antibiotic Therapy

- Antibiotic therapy is indicated when there is:
 - Rapid swelling
 - Diffuse swelling
 - Compromised host
 - Fascial space involvement
 - Pericoronitis
 - Osteomyelitis
- Initial therapy is usually empirical, based on the likely source and organism involved. When available, therapy should be guided by Grams stain and culture results. Simple infections may be managed with enteral antibiotics, whereas severe infections require intravenous medications (Appendix 12, Table A12-4). The following list outlines the microbiologic characteristics of odontogenic infections.
 - Most commonly indigenous bacteria
 - Primarily aerobic Gram-positive cocci, anaerobic Gram-positive cocci, anaerobic Gram-negative rods
 - Most frequently polymicrobial (mean number of organisms is 5)
 - Mixed anaerobic/aerobic 60%
 - Aerobic 5%/anaerobic 35%
 - Most frequent aerobic organism: *Streptococcus* spp. 7%
 - Increasing prevalence of *Staphylococcus* spp.
 - Most frequent anerobic organisms are *Streptococcus*, *Peptostreptococcus*, *Bacteroides* (now *Prevotella* and *Porphyromonas*) spp.
- Therapy should be parenteral with severe or rapidly progressing infections
- When instituting empirical therapy, always use the least expensive, least toxic, and narrowest-spectrum antibiotic that will cover the likely organisms (Appendix 12, Table A12-4)

- Bacteriocidal antibiotics are preferred over bacteriostatic
- Patients must be asked about a history of drug allergy or current medications that could interact with the antibiotics used (e.g., birth-control pills, warfarin therapy, and gastric-ulcer medications such as cimetidine) (Appendix 12, Table A12-7)

Diagnostic Imaging

Diagnostic imaging studies can help guide surgical therapy. They are used in cases of deep fascial space infections, rapidly spreading infections, and infections impinging on vital structures such as the airway. Studies to be considered include:

- Computerized tomography (CT): This is the gold standard for assessing head and neck infections (Figure 5.1). It is useful for determining the extent of infection, in both soft tissues and bone. Studies can be done with intravenous contrast to assist in determining the extent of hyperemia surrounding the infectious site.
- Magnetic resonance imaging (MRI): This modality is useful for determining the extent of infection, especially within soft tissues. The advantage is a lack of ionizing radiation exposure. The disadvantages are that it is more expensive than CT and patients must lie still for lengthy periods because of a prolonged delay for image capture.
- Ultrasound: This modality could be used for locating abscess cavities within soft tissues.

Laboratory Data

Aside from culture and sensitivity testing, a few laboratory tests can aid in the diagnosis and management of infections.

- Complete (full) blood count with differential:
 - Leukocytosis (WBC greater than $10,000/\text{mm}^3$) is indicative of infection.
 - A “shift to the left” (presence of many immature or “segmented” neutrophils) on differential WBC count is seen with acute infection. Chronic infections do not have this shift and usually have a marginally increased white cell count.
 - Elevated platelet count (greater than $500,000/\text{mm}^3$) in some cases.
- Chemistry studies:
 - Blood urea nitrogen (BUN) may be elevated due to dehydration.
 - Hypernatremia (Na^+) and hypochloremia (Cl^-) also may be seen with dehydration.
 - Albumin levels may drop due to malnutrition or necrotizing infections. Low albumin levels are noted in the most severe and morbid of infections.
- Urinalysis:
 - Dehydration leads to an increase in specific gravity (greater than 1.025).
 - Severe dehydration can lead to oliguria and acute tubular necrosis and renal failure.
 - Severe infections can demonstrate proteinuria.

Surgical Management of Odontogenic Infections

Diagnosis

Prior to any surgical intervention it is imperative that the offending source be isolated and the specific spaces involved with infection be delineated. This can be done by clinical examination supported by diagnostic imaging.

Removal of Source

When possible, the offending source of the infection should be removed. In many cases this may be adequate treatment (e.g., a tooth extraction with adequate spontaneous drainage from the socket). Removal of the source may include:

- Extraction of a tooth: The extraction of an acutely infected tooth is indicated for the management of an acute infection where the offending tooth is the etiology. This is the appropriate treatment, except when such removal would open up additional fascial planes and spaces to the infection, for example, removal of an impacted tooth requiring elevation of a flap
- Pulpectomy or endodontic procedures in permanent teeth
- Likely extract if a primary tooth
- Removal of foreign bodies (e.g., bullet fragment or bone plate)
- Removal of necrotic bone
- Removal of infected sutures (stitch abscess)

Principles of Incision and Drainage (I&D)

When removal of the source is inadequate for allowing elimination of abscessed areas, surgical access is warranted to promote gravitational drainage, although this is rarely needed in children. The particular areas to be drained or explored should be determined presurgically so that they can be prepared accordingly. Basic principles of surgical drainage are:

- When in doubt, drain. With few exceptions, an I&D will only help the situation and, even when non-productive, will permit a pathway of least resistance for future drainage should it begin after the procedure.
- Prior to I&D, consideration must be given to patients with bleeding disorders and those who are taking anticoagulant therapy or immunosuppressive agents.
- Extra-oral incisions should be placed where they will be cosmetic and allow gravitational drainage with the patient in the supine or upright position.
- All drains should be secured with a suture to prevent premature loss.
- All incisions should be designed to prevent injury to important structures (e.g., nerves, blood vessels, ducts).
- Drains should be left in place and monitored until they are no longer productive, generally one to three days.

Anesthesia

- Local anesthesia injected into an abscess usually fails because of the acidic pH of the region.
- Local anesthesia infiltrated into the mucosa and/or regional block injections are usually successful (e.g., mandibular block or V2 block).
- Care should be exercised to inject around an area of infection, not through it.
- If local anesthesia is not possible, general anesthesia may be necessary, especially for larger or deeper fascial space infections.
- Trismus, a common finding with infections near the muscles of mastication, is a product of pain and subsequent spasm in acute infections (not necessarily true with chronic infections, where fibrosis may have occurred). When a patient is placed under general anesthesia, mouths with acute infections will almost always open without difficulty.

Intra-Oral I&D (Figure 5.2)

- Locate the area of maximum fluctuance. Provide local anesthesia with mucosal infiltration and/or regional anesthesia.

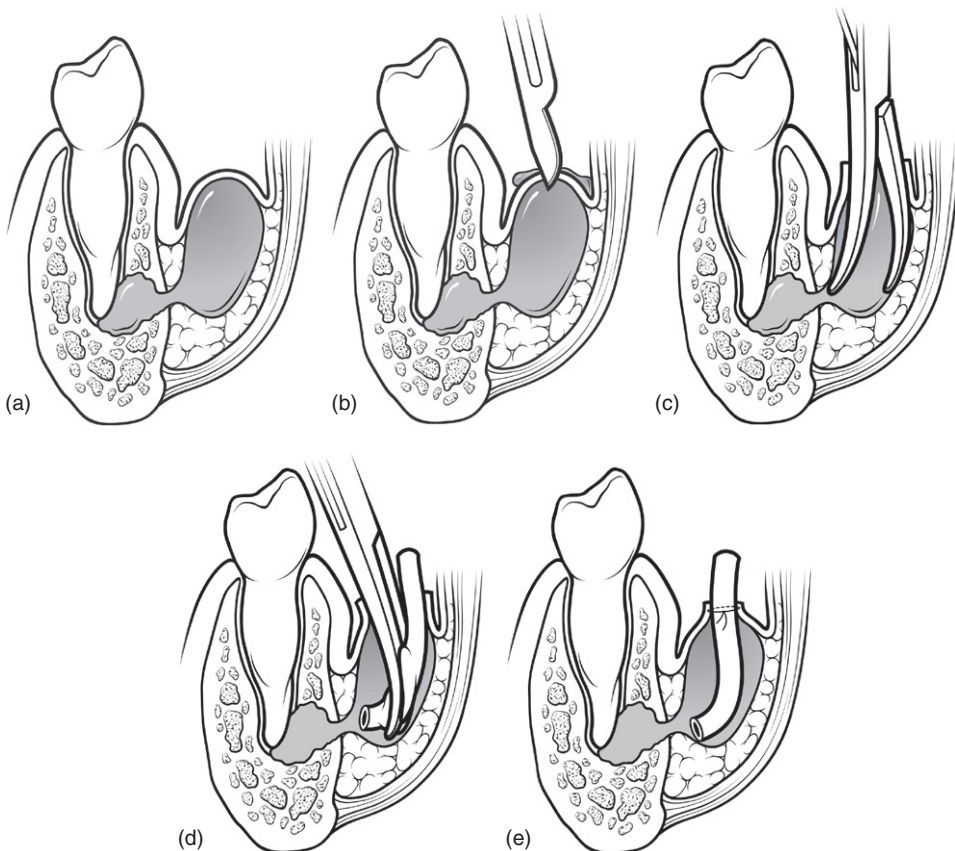


Figure 5.2. Intra-oral incision and drainage.

- Using a number 15 scalpel, make an incision in the mucosa overlying the area of fluctuance, 1.5 times as wide as the drain that is to be placed in the abscess cavity.
- Use a mosquito hemostat to bluntly explore the abscess until purulence (pus) is obtained, and then the periosteum is traversed.
- When all the purulence has been evacuated and the I&D site irrigated with normal saline, place a small Penrose drain (a hollow latex tube) or other latex material drain well into the abscess cavity and suture it to the end of the wound with a 3-0 non-resorbable suture.
- Leave approximately 1 cm of the drain visible in the mouth.
- Encourage the patient to use saline rinses to keep the drain open.

Extra-Oral I&D (Figure 5.3)

- The procedure may be performed under local anesthesia, with IV sedation, or under general anesthesia. If local anesthesia is to be used, inject 2 to 3 cc in the

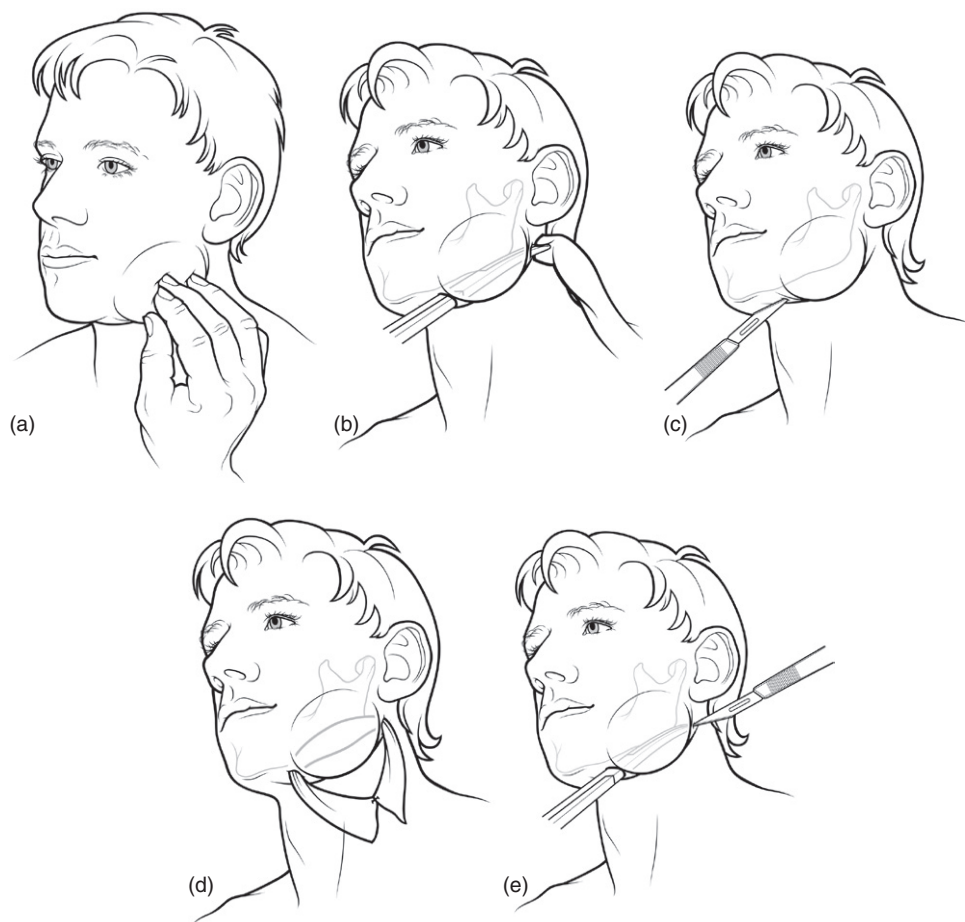


Figure 5.3. Extra-oral incision and drainage.

region of the incision and another 2 to 3 cc in the path of the proposed procedure. Prepare the area to be drained with a povidine iodine solution (not tincture or scrub, because these may cause corneal ulceration) and drape in a sterile fashion, allowing plenty of room to work. Locate areas of fluctuance, any areas of compromised skin, and an area of non-compromised skin that would allow for dependent gravitational drainage and a good cosmetic scar. Theoretically, ideal places are in skin creases or just below the mandible. In reality, many of these infections have already compromised the skin and subcutaneous tissues overlying the abscess, and thus a necrotic pathway to the abscess already exists.

- Make an incision 1.5 times the width of the anticipated drain, through the skin and into the subcutaneous tissue. Using a hemostat, bluntly dissect into the abscess cavity. Open the hemostat to allow the purulence to flow freely and then be sure to traverse the periosteum.
- When small spaces are to be drained, it is advisable to run a one-quarter-inch Penrose drain. When large or multi-space infections are drained, one-inch drains are used. Only under the most ideal of situations can a drain be run through the space and exit it at the other end of the space, thus creating a “through and through” drain, which ensures that the drain is in the space and not just folded onto itself under the skin margin. This is the exception.
- Place the drain into the depth of the abscess cavity and suture it to the margin of the incision with a 2-0 or 3-0 non-resorbable suture. Cover the area with a sterile, non-sticky dressing such as Telfa™ (Melolin) and gauze (Figure 5.3).

Postoperative Care

- Maintain the drain in place for as long as it is productive, generally one to three days. Although drains sometimes need to be left in for as long as a week (in severe infections), at some point they become a foreign body and will prolong the drainage or permit a retrograde infection to occur. Therefore, removal at the earliest possible time is recommended.
- Change the dressings as often as necessary to keep the wound clean, at least once per day.
- Maintain the appropriate antibiotics for at least 24 hours after the pyrexia has resolved.
- Upon removal of the drain, allow the incision to granulate under a sterile dressing. Intra-oral incisions require no dressing.

Most Common Reasons for Infection Management Failure

- Inadequate surgery
- Depressed host defenses
- Foreign body unidentified
- Antibiotic problems (noncompliance, wrong bacterial diagnosis, wrong antibiotic, dose too low, penetration)

Salivary Gland Emergencies

Acute Parotid Infections

Etiology

Acute parotid infections are usually caused by retrograde infection from the oral cavity and are secondary to decreased salivary flow from dehydration or an immunocompromised state. The causative organisms are usually staphylococci or streptococci but many other organisms also have been implicated. Viral acute parotitis (mumps) is common in children as a bilateral swelling. The most common candidates for acute parotid infection are:

- Newborns
- Elderly patients
- Postsurgical patients
- Patients on dehydrating medications (e.g., diuretics, anticholinergics, tranquilizers, antihistamines)
- Immunocompromised patients
- Patients with primary or secondary Sjögren's syndrome (Appendix 6, Table A6-5).

Diagnosis

The diagnosis is usually straightforward due to the unique clinical presentation, which includes:

- Sudden onset of firm swelling, pain, and erythema of the preauricular (parotid) or floor of mouth/submandibular region (sublingual/submandibular gland)
- 20% of cases are bilateral
- Temperature elevation (not always observed in an elderly person, where the infection is more likely manifested as confusion and disorientation)
- Leukocytosis
- Thick, purulent discharge from Stenson's duct (opposite maxillary first molar) or Wharton's duct upon milking

Differential Diagnosis

- Sialosis
- Pneumoparotid: Demonstrates crepitus and does not have the purulent discharge
- Mumps (bilateral)
- Lymphadenopathy: Discrete enlargement without purulent discharge

Treatment

- Intravenous rehydration is the cornerstone of treatment in most cases. Careful monitoring and control must be exercised with elderly or debilitated patients to prevent fluid overload.
- Discontinuation, if possible, of any medicines associated with xerostomia.
- Empirical antimicrobial therapy with an antistaphylococcal agent with anti-beta-lactamase activity, such as a cephalosporin or dicloxacillin or cloxacillin. When anaerobic organisms are suspected, as in longer-standing cases, consider metronidazole.
- Culture and sensitivity testing of any purulence.
- In severe, non-responsive cases, surgical drainage may be required. This is accomplished by blunt dissection using a small submandibular or retromandibular incision and placement of a small Penrose drain. Care must be exercised to avoid the facial nerve in cases of suppurative parotitis.

Obstructive Sialadenitis

Etiology

Stones in the submandibular or parotid gland or duct are the major cause. However, ductal stricture from scarring, tumor, foreign bodies, or mucous plugs can cause an identical clinical picture. Obstruction leads to back-up of saliva within the gland and a painful enlargement because the glands are bound by a restrictive, fibrous capsule.

Diagnosis

- Pain and swelling of the affected gland, usually just before mealtime
- Gradual reduction in size within hours to days
- More common in submandibular gland or duct
- Milking of duct is either nonproductive or produces a thick, viscous discharge if the gland is secondarily infected
- Occlusal, panoramic or facial X-rays may reveal radiopaque stones. Cone beam technology is particularly helpful in not only diagnosing a sialolith, but also in pre-surgical location (Figure 5.4). Nonradiopaque stones can be verified with xeroradiography and mucous plugs can be demonstrated with sialography.

Treatment

- Submandibular stones distal to the mylohyoid flexure (in the floor of the mouth) can be removed by making a small incision over the duct using local anesthesia. The stone is enucleated and the duct left unsutured to fistulate. A silk suture may be passed around the proximal portion of the duct prior to the procedure to prevent accidentally pushing the stone posteriorly.

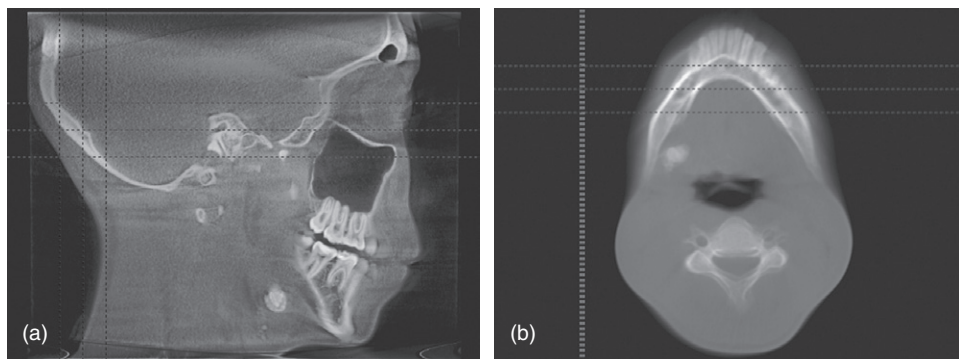


Figure 5.4. A cone-beam CAT scan illustrating a large radiopaque submandibular sialolith in the (a) axial and (b) sagittal views.

- Submandibular stones proximal to the flexure or in the gland itself are usually treated by excision of the gland in the operating room (theater) under general anesthesia.
- Stones in the parotid duct may be located by ultrasonography and enucleated through a 5-mm skin incision or, occasionally, by dilation of the duct.
- Lithotripsy, either extra corporeal or intraductal, may be attempted.

Maxillofacial Trauma

General Principles of Care

When dealing with multiple trauma, with few exceptions, facial injuries are not usually the first priority of treatment. Nevertheless, when the facial injuries are the most obvious problem, the dentist is often the first healthcare provider to see the patient. It is important to perform an overall assessment before proceeding to examine a specific oral or facial problem. As with all emergencies, the initial evaluator should always do the “ABCDs” (airway, breathing, circulation, disability) first. Establishment of adequate airway with appropriate respiratory and cardiac function along with the determination of neurologic status are paramount. Medical consultation should be obtained immediately for any aberration in the patient’s condition. No analgesics, sedatives, or anesthetics (or any other drug that could increase intracranial pressure) should be administered until neurologic or other medical complications have been ruled out.

The Initial Evaluation

Patent Airway

The airway is often compromised by facial trauma as a result of fracture displacement, foreign bodies, or the inability to maintain forward tongue posture.

- Assure a clear airway and normal rate and depth of breathing. Conscious patients generally assume the body position that helps airway patency and they should be allowed to do so.
- Remove all foreign objects (e.g., pieces of teeth or restorations) from the oral cavity. Avulsed teeth may be implanted and then splinted if the patient is stable after medical assessment (and if it is still within the recommended time for implantation). Open the airway with a chin thrust, an oral or nasal airway, or if necessary by cricothyroidotomy, if unable to place an endotracheal (ET) tube.

Vital Signs

Vital signs can be used to determine adequate circulatory function and serve as indicators of intracranial injury.

- Decreased blood pressure and/or increased heart rate may indicate hypovolemia with potential for shock.
- Increased intracranial pressure is often associated with confusion and nausea followed by a decreased heart and respiratory rate in conjunction with increased blood pressure (Cushing's triad). This situation warrants immediate medical attention.

Neurologic Evaluation

Careful examination can provide valuable information regarding both localized facial neurologic and intracranial injuries (see the Glasgow Coma Scale, Appendix 16). Obtain neurosurgical consult for:

- Lack of spontaneous eye opening
- Disorientation to verbal questioning
- Inability to obey verbal commands
- Rhinorrhea or otorrhea (indicative of cerebrospinal fluid leakage secondary to an anterior or middle cranial fossa fracture). Perform rapid and systematic cranial nerve examination:
 - Eyes: Eye movements and sensation are used to evaluate cranial nerves (CN) III, IV, V, and VI. If the eyes abduct fully, CN VI is intact. All the other eye movements (tested by having the patient follow finger movements in all four quadrants) indicate the status of CN III and IV. If the pupils are equal, round, and reactive to light and accommodation (PERRLA), then CN II is unimpaired. If the patient feels a wisp of cotton on the cornea, CN V is intact. Vision can be tested grossly with a hand-held eye chart.
 - Face: CN V and VII are evaluated by examining the facial musculature and its sensation. A dental explorer or needle can be used to evaluate symmetric sensation to light touch, a function of CN V sensory division. Jaw opening without deviation can be used to evaluate the CN V motor component. However, it must be remembered that a jaw fracture can cause the jaw to deviate upon opening. Symmetry of the facial muscles on grimacing, frowning, and eye closing indicates a normally functioning CN VII.

- Speech and soft palate: If speech appears normal and the soft palate moves normally, CN IX and X are intact.
- Tongue: Protrusion of the tongue without deviation from midline is normal for CN XII.
- Hearing: This can be tested by rubbing two fingers gently together, first behind one ear then behind the other. The auditory nerve (CN VIII) can be tested in this manner.
- Bilateral shrugging of the shoulders against pressure indicates normal function of the spinal accessory nerve innervated by CN XI.

Cervical Examination

Traumatic facial injuries have a high correlation with neck injuries and it is important to maintain a high suspicion for the presence of associated cervical spine injury. Any significant facial trauma, therefore, mandates the need for a complete cervical-spine series of radiographs. Normal cervical-spine radiographs do not completely rule out spinal cord injury. Thus, consultation with an orthopedic surgeon, neurosurgeon, or trauma surgeon, depending upon the policies of the specific emergency department, are warranted. Only after ruling out cervical injury should a cervical collar be removed and the head, neck, or facial examination be performed.

Indications for Immediate Emergency Treatment

Although facial fractures do not usually require priority emergency management, exceptions include:

- Massive arterial bleeding
- Airway compromise
- Compound fractures should have at least temporary soft-tissue closure

Diagnosis of Facial Trauma

Although the diagnosis of facial trauma is usually an obvious one, much information can be gained from a thorough history and physical examination.

History

The patient, or someone at the scene, should be questioned about details including loss of consciousness, seizures, or hemorrhage. If any of these are positive, or if the patient has no memory of the incident, suspect intracranial injury and seek appropriate medical consultation.

Ascertain the source (e.g., fists vs. baseball bat), direction, number, and force of the blows. This can give significant clues to potential fractures or complicating injuries. For example:

- Injuries to the midline symphyseal region of the mandible often cause bilateral subcondylar fractures.

- Injuries to the lateral body can cause a contralateral subcondylar fracture.
- Penetrating wounds from instruments such as bullets or knives can cause central neurologic or vascular injury not easily visualized on the surface. Injuries involving high density objects (e.g., baseball bat) should be suspected of comminution.

A history of immunization for tetanus should be obtained, and the administration of the appropriate anti-tetanus therapy for contaminated or crush injuries, or for those beyond five years of the last immunization.

Question the patient about pre-existing asymmetries, abnormalities, or conditions. A change from the pretrauma occlusion often indicates a fracture within the facial skeleton. Also ask about pain, paresthesia or anesthesia, hearing or visual disturbance, breathing difficulty, headache, dizziness, change in occlusion, feeling of crepitus, or dysphagia.

Head and Neck Physical Examination

The examination should be carried out in a systematic fashion from the cranium to the clavicles.

Inspection

Careful examination for the following:

- Asymmetry or flatness.
- Ecchymosis: If this is seen in the mastoid region (Battle's sign), periorbital areas bilaterally ("raccoon eyes"), retropharyngeal region, or associated with hematotympanum without evidence of direct trauma, it is indicative of a basilar skull fracture. Ecchymosis in the floor of the mouth is considered pathognomonic of a mandibular fracture
- Lacerations that could indicate underlying fractures
- Obvious proportional changes of facial dimensions. Changes in facial height or width, intercanthal width (normally less than 35 to 40 mm) or apparent ramus height can indicate fracture
- Examine occlusion carefully for any changes from the preoperative state noted. Broken teeth, steps in the occlusion, tooth mobility, and an anterior open bite are all signs of fracture

Palpation

Whenever possible, palpate in a bilateral, bimanual fashion (placing the area to be examined between one hand or finger and another). This aids in determining small discrepancies:

- Extra-oral: Palpate all facial bones for "steps," mobility, or crepitus from displaced fractures. Palpation should begin in the frontal region and progress to the orbital rims, zygomatic arch, malar buttress, and entire inferior border of the mandible.

- Intra-oral: Palpate bimanually to feel for steps, hematoma, or mobility. Carefully palpate the malar buttress for tenderness or steps, both indicative of a zygoma or maxillary fracture. Examine for maxillary fractures by placing the thumb and index finger of the “reference hand” on either side of the nasal bridge while the other hand is used to grasp the anterior maxillary ridge above the teeth:
 - Movement of the maxilla in the non-reference hand only indicates LeFort 1
 - Movement of the maxilla in the reference hand only indicates LeFort 2 or 3
 - Movement of the maxilla in both hands indicates multiple fractures of the midface
 - Movement at the lateral orbital rim indicates a LeFort 3 fracture or combined fractures with a zygoma fracture
- Ask the patient to open and close the mandible. Maximum opening between the incisal edges, deviation on opening, and joint sounds are noted. The joint is felt by placing two fingers over the preauricular area, or in the ear canals, during excursions. Tenderness, popping, crepitus, or clicking can indicate internal trauma to the joint or a condylar fracture.
- Air emphysema in the tissues is manifested by a “crackling” feeling and sound (like puffed rice cereal in milk) and indicates a fracture of a sinus or a laryngeal injury.

Radiographic Evaluation

Although careful physical examination is certainly the best diagnostic tool for facial fractures, radiographic imaging can provide confirmation of clinically suspected fractures as well as additional information.

Mandibular Fractures

- The panoramic radiograph is the preferred image for mandibular fractures in that it will confirm the presence of a fracture in 92% of patients. It provides an excellent overall view of the mandible (Figure 5.5).



Figure 5.5. The panoramic radiograph is unsurpassed in verifying mandibular fractures. Noted in this image is a left symphysis and right subcondylar fracture.

- Right and left lateral oblique views show the body and angle of the mandible and the position of the condyle.
- The submental vertex (bilateral “jug handle”) view shows the inferior border of the mandible and the zygomatic arches.
- The posterior–anterior (PA) view shows the symphyseal region.
- Towne’s view provides an excellent view of the condyles and condylar necks including their position in the fossa.
- Occlusal view: When a midline fracture or a fracture involving the alveolus is suspected, an occlusal view may be helpful.
- Periapical films: Used to show undisplaced fractures of alveolar bone and tooth root fractures.
- Computed tomography is effective for the diagnosis of intracapsular fractures, which are many times not evident with conventional radiography.

Maxillary Fractures

- Computed tomography is the gold standard for confirmation of midfacial fractures (Figure 5.6).

Zygomatic Fractures

- Computed tomography is the gold standard for confirmation of midfacial fractures.

Multiple Facial Fractures

- Computed tomography is the gold standard for confirmation of multiple and midfacial fractures.

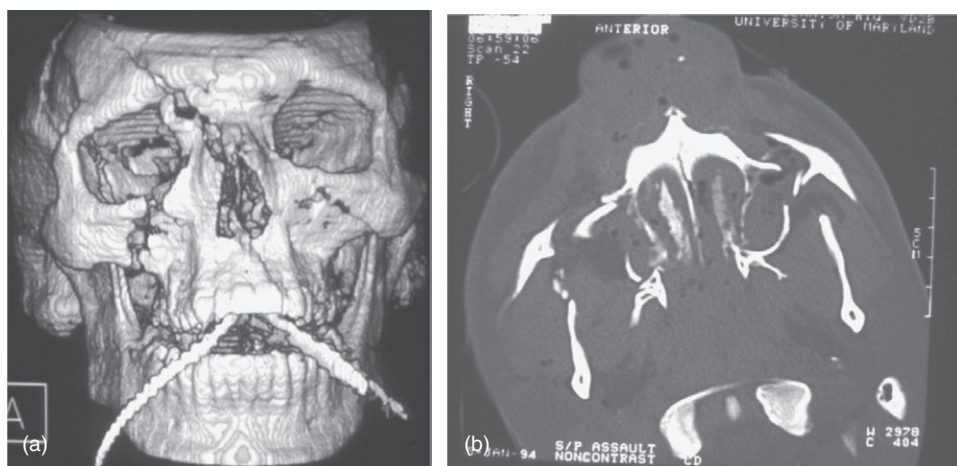


Figure 5.6. Computed tomography is the gold standard for verifying midfacial fractures and directing surgical management. (a) The axial view depicts a posteriorly displaced maxillary fracture at the LeFort I level. (b) The three-dimensional reconstruction illustrates a “pyramidal” or LeFort II fracture.

- **Angiography:** Penetrating injuries, such as a gunshot or knife wound to the region below the inferior border of the mandible, require angiographic determination of the extent of vascular injury. If located between the inferior border of the mandible and clavicular head, they may also need surgical exploration.

Treatment Options for Facial Fractures

The aim is anatomic reduction of the fracture, fixation for an adequate period to allow for bone repair, and general supportive and rehabilitative care.

Temporary Stabilization

Mobile fractures of the facial skeleton are disconcerting to the patient and family. It is often necessary, for practical or medical reasons, to delay definitive treatment for hours or even days. To decrease the patient and family's anxiety, temporary stabilization may be used.

- **Barton bandage:** A Barton bandage is a simple bandage wrap composed of a conforming gauze bandage that is wrapped first vertically around the head several times and then horizontally around the forehead several times. This bandage is a simple and rapid mechanism for preventing mandibular opening (Figure 5.7). It can be secured with silk tape or by wrapping the end of the gauze underneath the dressing.
- **Risdon wire:** For anterior mandibular fractures, a 24-gauge wire twisted around each canine and first premolar and then twisted to each other in the midline is a quick method that will rapidly but temporarily approximate the fracture and



Figure 5.7. Barton bandage.

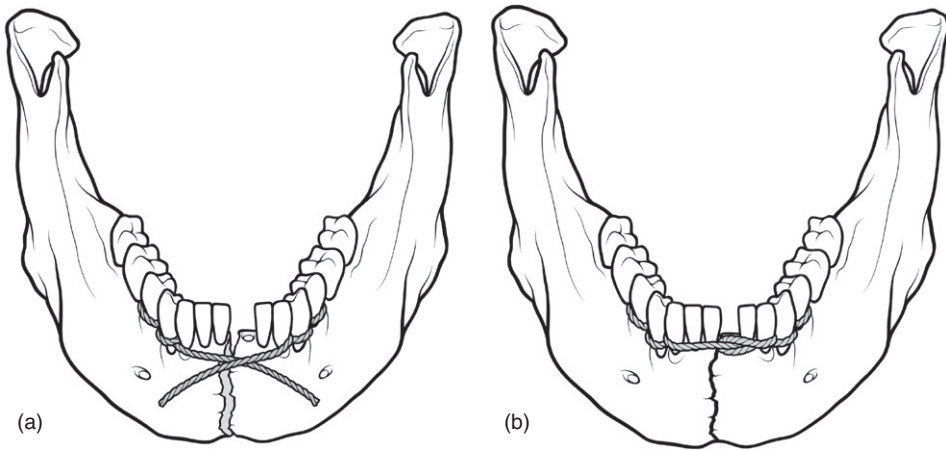


Figure 5.8. Risdon wire technique.

prevent localized mobility. This can also be used with the Barton bandage (Figure 5.8).

Definitive Reduction and Fixation

The gold standard is open reduction with internal fixation with titanium plates and screws. When undisplaced fractures occur behind the teeth, or when fractures occur within the dentate segment, closed reduction with maxillomandibular fixation (MMF) for four to six weeks will often suffice for definitive treatment.

- Closed reduction with Ivy loops: A rapid method of obtaining fixation, used only for short-period (hours or days) MMF (Figure 5.9). This can easily be performed in the emergency department or clinic under local anesthesia.
- Erich arch bar maxillomandibular fixation: This is the best and most common way to obtain MMF. A 24-gauge wire is passed around the neck of each tooth using a wire twister. The wire is then twisted down over the arch bar with the lugs facing up in the maxilla and down in the mandible. The lugs can then be used to place interarch elastics or a box-type wire (Figure 5.10). This procedure can be performed with local anesthesia/IV sedation or general anesthesia. It begins by reducing the arch bar in size to fit the maxillary or mandibular arch. Ideally, the arch bar should span from second molar to second molar. Yet, canine to first molar ligation will achieve stability. Under compromised conditions, such as avulsed teeth, missing teeth, or carious or periodontally involved teeth, at least three sound teeth per quadrant is necessary. The arch bar is then contoured to fit the curve of Spee and curve of Wilson. The first premolar is secured first to stabilize the arch bar and to verify length, contours, and correct placement. The posterior teeth are then ligated, followed by the anterior teeth.

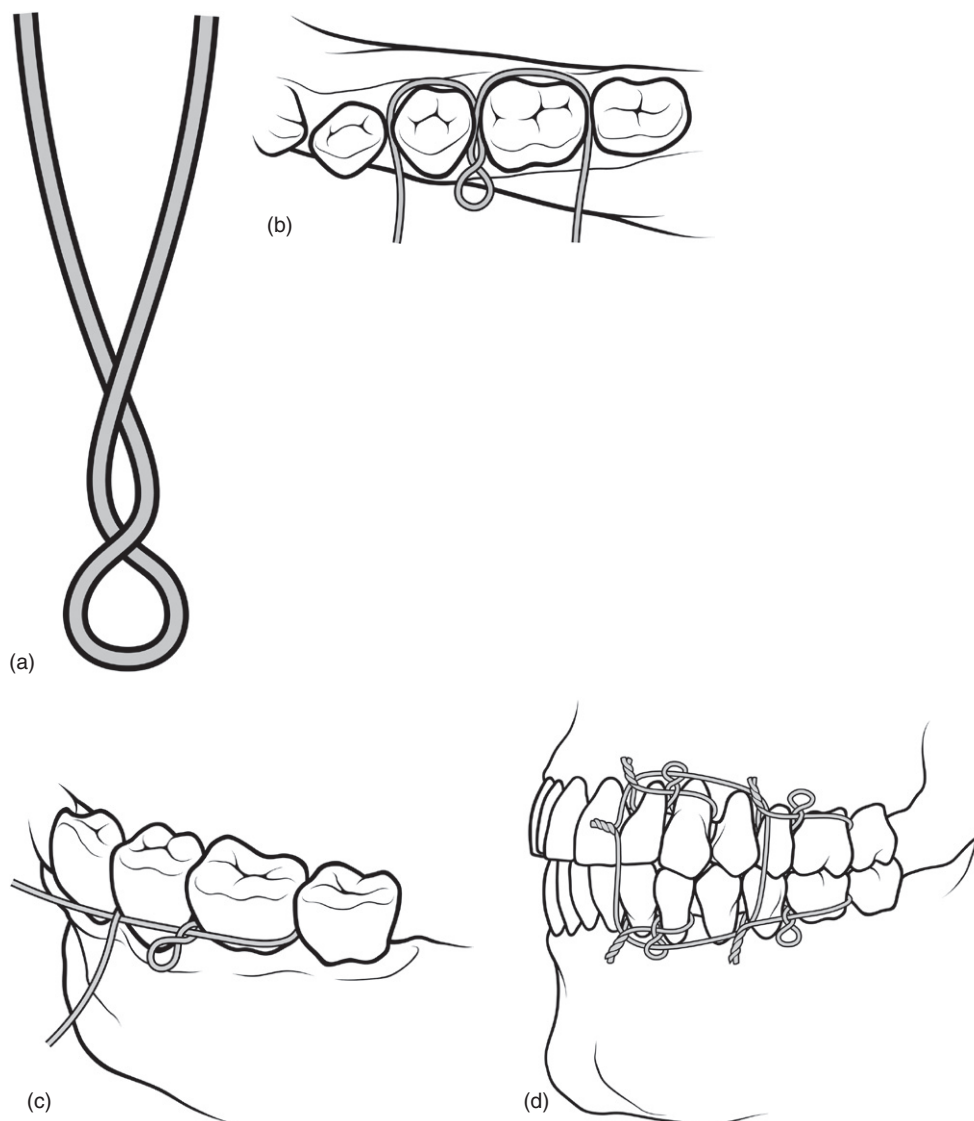


Figure 5.9. Closed reduction with Ivy loops. (a) Creation of the loop. (b) Insertion of the wire through the embrasure, around the teeth, and back through the embrasures. (c) Securing of the final loop. (d) Maxillomandibular fixation.

Dental and Dentoalveolar Trauma

Traumatic injuries to the teeth and supporting structures are a common ED emergency (affecting some 5% of all school-age children). A brief but comprehensive assessment of the overall patient should be made to rule out other less obvious concomitant injuries. Intracranial, cervical, or facial bone injuries often accompany dental trauma and can be overlooked. Although dental trauma is not the first priority for multiply injured patients, successful management of many dental injuries requires proper diagnosis and treatment within a limited period of time.

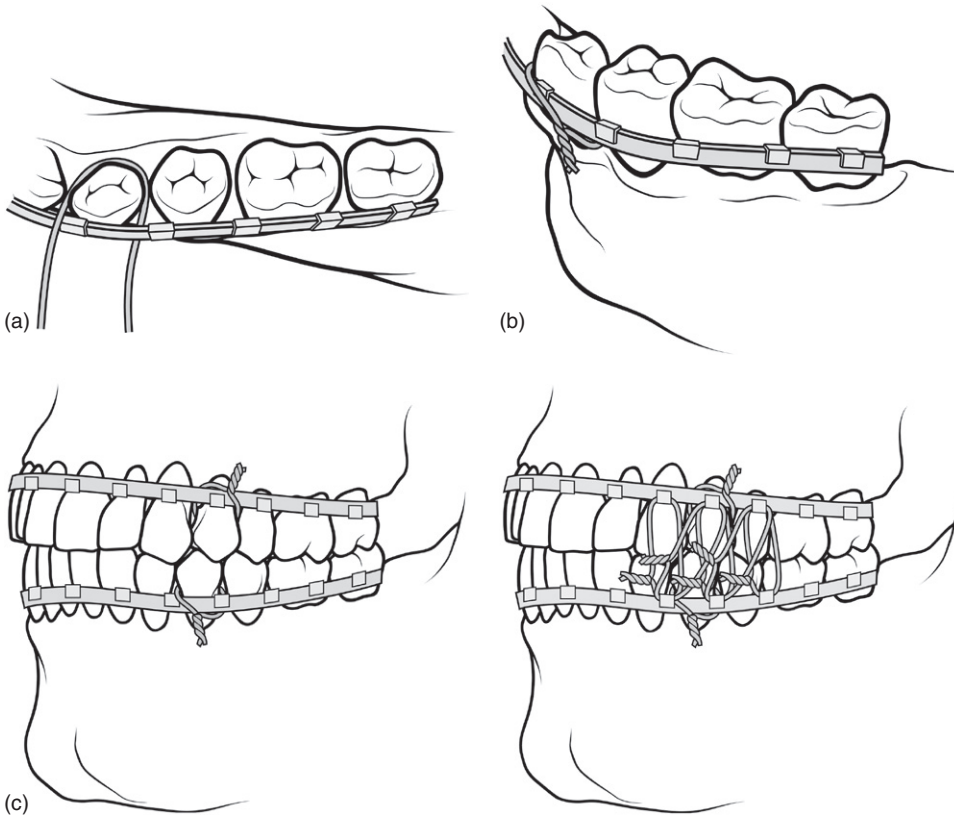


Figure 5.10. Erich arch bar technique. (a) Initial introduction of the ligation wire. (b) Securing of the arch bar to the tooth with the ligation wire. (c) Maxillomandibular fixation.

History and Physical Examination

A good history is important to determine the nature and time of the injury, the likely dental injuries from that type of trauma, other possible secondary injuries, and any pre-existing dental problems (e.g., malocclusion, previous dental trauma). The physical examination should include a rapid but adequate general examination as well as detailed head and neck and oral examinations.

- View with suspicion any alteration in dental occlusion from the patient's stated normal as evidence of displaced teeth, dentoalveolar fracture, or facial bone fractures.
- Account for all the teeth. Teeth unaccounted for at the scene or on examination should be considered to have been aspirated, swallowed, or displaced into the soft tissues or sinuses. Appropriate radiographs (soft tissue neck, PA and lateral skull, chest X-ray and/or flat plate of the abdomen) should be ordered to localize the fragments. Perform a thorough search for any foreign bodies, teeth fragments, or debris in the soft tissues of the lips or floor of the mouth. This is a

particularly common finding and is associated with a high incidence of infection.

- Perform a careful examination to determine which teeth are traumatized, the presence of mobility, the direction and magnitude of any displacement, the presence of crown or root fractures, evidence of pulpal involvement such as bleeding of pulpal tissue, and empty sockets. The color of the involved teeth and initial percussion sensitivity should be noted. Pulp testing is of limited value in acute injuries. Differentiate between tooth displacement or fracture and dentoalveolar trauma, where the alveolus itself is also fractured. Grasp the involved ridge between the thumb and forefinger of one hand while grasping an adjacent, unaffected area with the other hand to check relative mobility. There may be mobility of the entire alveolus with teeth intact, one alveolar plate with teeth intact, one or both cortical plates with teeth also mobile within the segment, or just tooth mobility with intact cortical plates. Examine thoroughly for any mandibular or maxillary fractures.

Radiographic Examination

Radiographic examination should include a panoramic radiograph and periapicals of the involved teeth, if possible. In small children, or uncooperative adults, occlusal X-rays are often easier to obtain and are clinically useful. When dental fractures are suspected, a second film from another angle is often useful in diagnosis. When fragments are suspected to be lodged in the lip or floor of the mouth, computed tomography is the method of choice for assessing the patient and confirming or refuting their presence. For dentoalveolar trauma, examine the radiographs for:

- Root fractures
- Degree of extrusion or intrusion
- Pre-existing periodontal disease
- Degree of root development
- Dimension and location of pulp chamber and root canals
- Alveolar or jaw fractures
- Foreign bodies (e.g., tooth fragments) lodged in soft tissues

Classification and Treatment (Figure 5.11)

Crown Infraction, Craze Line, or Crack

- Does not involve loss of tooth structure.
- No treatment usually necessary.
- Due to propensity for future fracture, should have continued follow-up.

Uncomplicated Crown Fracture

- Involves enamel or enamel and dentin only.
- Treatment: Account for missing segment (radiograph of soft tissue may be necessary). Smooth off sharp edges and place a temporary glass-ionomer cement/

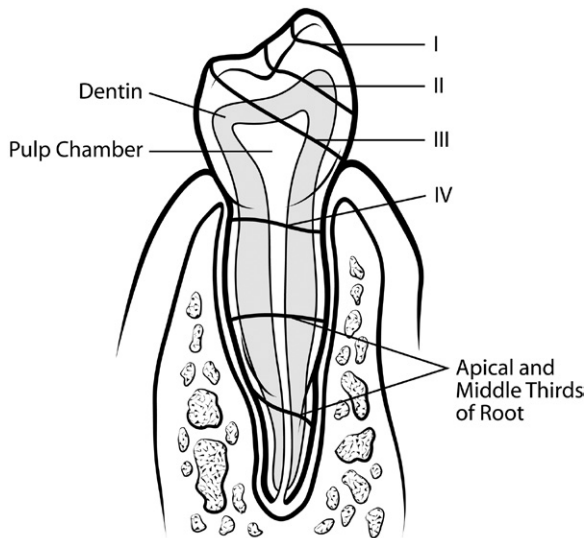


Figure 5.11. Tooth fracture classification.

compomer bandage or permanent restoration, depending on depth. Follow-up is important to monitor pulp and periodontal health. The tooth should be pumiced, cleaned, dried, and etched. The area should be coated and/or built up with a protective restoration such as unfilled resin. Alternatively, reattach the tooth fragment (if available) using composite resin and dentin bonding agents.

Complicated Crown Fracture

- Involves enamel, dentin, and pulp.
- If pulp exposure:
 - Direct pulp cap: Calcium hydroxide (CaOH_2) is placed on exposed pulp tissue if injury is within 24 hours and a very small exposure in permanent teeth.
 - If perforation of pulp is less than 1 mm and less than a few hours old, CaOH_2 or MTA can be placed over the exposure and a restoration placed as for a class II fracture.
 - If pulpal exposure is larger than 1 mm or more than 24 hours old, pulpectomy is followed eventually by conventional endodontics.
 - With large exposure and open apex, make access to the vital pulp. Amputate 2 mm of pulp and surrounding dentin in teeth fractured from 1 hour to 90 days. ("Cvek pulpotomy"). More amputation might be necessary in the case of a hyperemic pulp. Direct pressure should be applied to obtain hemostasis and CaOH_2 or MTA should be applied directly to the pulp stump. A composite "sling" is placed over the CaOH_2 or MTA. Copious irrigation should be used.
 - Pulpotomy or pulpectomy of primary teeth can be performed with a five-minute application of formocresol or ferric sulfate for a pulpotomy technique or filling of the root canals, after pulpectomy, with a resorbable paste.

- For primary anterior teeth with a fracture extending into the pulp, a pulpectomy is indicated if cooperation is good and provided that there is not significant root resorption, or an extraction if not. The pulpectomy may be filled with calcium hydroxide.
- Follow up carefully for pulp vitality and periodontal health.
- Restore tooth at follow-up dental visit

Complicated Crown–Root Fracture

- Involves enamel, dentin, and pulp.
- Permanent teeth: Treatment depends on restorability of teeth (i.e., pulp therapy vs. extraction).
- If pulp exposed and restorable, please refer to section above, under complicated crown fracture.
- Primary teeth: Usually extractions.

Root Fracture

- A root fracture is one that is apical to the cemento-enamel junction (CEJ) that involves dentin, cementum, and pulp.
- If a permanent tooth is injured at or coronal to the crestal bone (e.g., the cervical one-third), the coronal portion should be removed and endodontics begun. The endodontic procedure is completed, and the restoration is made with a post and core. The root is extruded orthodontically and the crown is fabricated. Alternatively, periodontal surgery may be used for the crown lengthening.
- If the fracture is in the middle one-third of the root, the coronal fragment should be repositioned, if displaced, and splinted for one month to the adjacent teeth. This allows healing by the formation of calcified tissue, bone, connective tissue, or granulation tissue. Pulpectomy and conventional endodontic therapy should be begun within seven to 10 days if evidence of pulpal pathology is apparent. Endodontic therapy can be done on the coronal portion only if there is no evidence of periapical pathology. If the fragments are widely displaced or the tooth is persistently mobile, extraction should be considered.
- If the fracture is in the apical one-third of the tooth or root, the fragments should be left alone and observed carefully for development of periapical pathology or signs of pulpal necrosis. If the coronal portion is mobile it may need to be removed for patient comfort.
- Fractures of the root in deciduous teeth, with the exception of those in the apical one-third, which require only observation, are an indication for extraction. Care must be taken to avoid damage to the developing permanent tooth bud. Small pieces of root can be left behind if their removal would jeopardize the permanent tooth. These injuries should be followed radiographically to confirm resorption of the fragment and eruption of the permanent tooth.

Subluxation

In the case of subluxation, the tooth is in the socket but shows greater than physiologic mobility after trauma.

- If mobility is mild, a soft diet and occlusal adjustment to take the tooth out of occlusion are often sufficient.
- If mobility is moderate to severe, splint to adjacent teeth (one tooth on either side) with nonrigid material (acid-etched, composite, and thin orthodontic wire or fishing line) for seven to 10 days.
- Obtain baseline radiograph, with repeat radiographs at one, two, six, and 12 months posttrauma.
- Perform CaOH_2 pulpectomy if external/internal resorption or periapical pathology develops.
- Observe primary teeth with slight mobility radiographically. If the tooth becomes nonvital, treat with pulpectomy or extraction. For moderate to severe mobility, primary teeth should be extracted.

Intrusion

Intrusion occurs when a tooth is pushed farther into the socket following trauma. This means that the tooth may have perforated the buccal or palatal plates, or has perforated the floor of the nose or sinus.

- Observe the tooth for re-eruption, but if this does not occur spontaneously, apply gentle orthodontic traction at the rate of approximately 0.3 to 1 mm per week. Surgical repositioning and splinting may be indicated if there is interference with occlusion.
- With moderate intrusion of tooth with open apices, endodontic therapy may be delayed until loss of vitality is suspected. For fully formed roots, start CaOH_2 pulpectomy within seven to 10 days of injury and fill permanently with chromic gutta percha after six to 12 months if resorption is arrested or non-existent.
- Allow mild and moderately intruded primary teeth that do not appear to involve the permanent tooth to re-erupt spontaneously. Extract the tooth if gingival infection, loss/fracture of supporting buccal/palatal plate, severe mobility, in cross bite and interfering with occlusion, ankylosis, or permanent tooth bud impingement is suspected.

Partial Extrusion

The tooth is partially avulsed or otherwise displaced in the socket.

- Digitally manipulate the permanent tooth back into the socket as soon as possible. Place one finger over the apical region to help prevent lateral perforation. Then splint with a nonrigid material such as monofilament nylon or 28-gauge wire to the adjacent teeth to prevent ankylosis.
- Due to the high probability of pulpal necrosis, perform careful clinical and radiographic evaluation frequently or begin endodontics soon after the injury (seven to 10 days).
- Extract primary teeth to prevent damage to the permanent tooth and interference with the occlusion.

Avulsion

In the case of avulsion, the tooth has been totally displaced out of the socket. This is a true dental emergency because the treatment and prognosis are extremely time dependent. The success of reimplantation is inversely related to the storage material and the time the tooth is out of the mouth. Teeth reimplanted within 30 minutes have a good chance of surviving, whereas those reimplanted after two or more hours have a limited survival. The goals of reimplanting teeth are to maintain the viability of periodontal ligament cells and impede resorption of the tooth. Milk, or contact lens solution in an emergency, are satisfactory storage media if the tooth cannot be stored in the patient's buccal sulcus.

- If dirty, the tooth should be grasped by the crown and rinsed gently in saline, tap water, or milk at the scene of the injury. Do not scrub off, brush the tooth, or handle the root.
- Immediately place the tooth back in the socket and hold in place with light pressure en route to the treating facility. There is no need to physically debride the socket prior to replacement. Gentle saline irrigation will remove debris.
- If the tooth cannot be replaced at the scene, it should be stored in the buccal vestibule or floor of the mouth for transport. If this is not possible, the tooth should be stored in a cup with the Hanks Balanced Salt Solution (HBSS), the patient's saliva, milk, saline, or water. Do not wrap tooth in tissue, towel, or foil or allow it to dry out.
- Once the tooth is reimplanted in a gently saline-irrigated socket, splint it to the adjacent teeth with a non-rigid or semi-rigid splint for seven to 10 days. If a concomitant alveolar fracture is present, maintain the splint for two to eight weeks. Longer splinting periods are required for more extensive fractures.
- In a permanent tooth with an open apex that has been replanted two hours after avulsion, radiographs and clinical exam should be performed in three to four weeks to look for evidence of pulpal pathology vs. revitalization. If pathosis is noted, root canal therapy should be instituted immediately. The canal should be cleaned, filled with CaOH_2 , and changed periodically (every three months) until apexification has occurred (usually six to 24 months). Then obturation with chromic gutta percha is indicated.
- For a permanent tooth with a partially to completely closed apex and less than two hours of dry time, the pulp should be removed in seven to 14 days. The canal is cleaned and CaOH_2 is placed. The American Association of Endodontics guidelines recommend only seven to 14 days of CaOH_2 treatment and immediate obturation of the canal with chromic gutta percha and sealer. These new recommendations to obturate a tooth so quickly after trauma are controversial.
- For permanent teeth with partially to completely closed apices and greater than 2 hours of extra-oral time, root canal therapy can be performed immediately. These teeth will eventually be lost to resorption but may be retained short term and are likely to ankylose. The tooth, once the canal has been extirpated extra-orally, can be soaked in sodium fluoride solution to discourage resorption once reimplanted.
- Do not replant primary teeth.
- Consider tetanus prophylaxis and antibiotics (Appendix 12, Table A12-4) and place the patient on a soft diet.

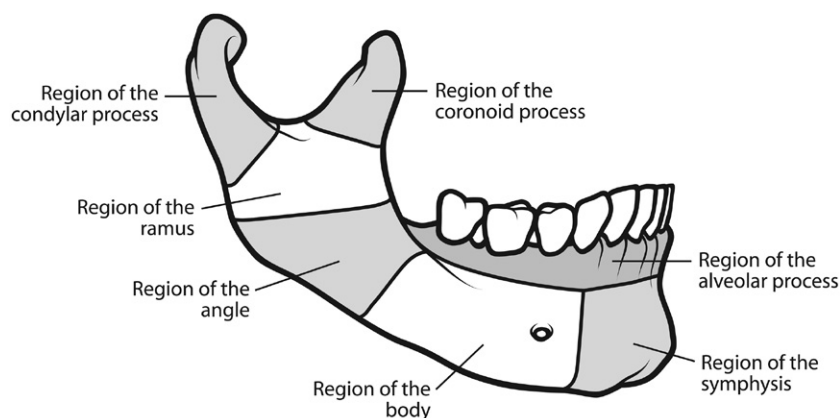
Mandibular trauma (Figure 5.12)

Figure 5.12. Regions of mandibular trauma.

Condylar (Intracapsular)

Fractures of the condylar head are vulnerable to fibrous and/or osseous ankylosis, especially in children and specifically girls. If bilateral, they may be associated with symphyseal fractures. Treatment is usually confined to careful observation and maintenance of mandibular function to prevent ankylosis.

Subcondylar or Condylar (Extracapsular)

Fractures that occur below the attachment of the TMJ capsule are considered condylar neck and subcondylar fractures. The etiology is the same as for intracapsular fractures. Treatment is dependent on the degree of displacement and dysfunction. If the occlusion is normal and there is no deviation upon opening, observation is adequate. If dysfunction is moderate, use arch bars with guiding elastics for two weeks. Open reduction is indicated if there is a foreign body in the joint, displacement laterally or into the middle cranial fossa, or if bilateral and associated with comminuted midfacial fractures.

Coronoid

Fractures of the coronoid process are rare. They are caused by a direct blow to the area. Treatment is usually unnecessary except for associated fractures.

Ramus

Fractures of the ramus are below the condylar neck but above the angle region. The etiology is usually a direct blow to the ramus (often seen with bullet wounds). They may be simple, but are often comminuted. Simple horizontal fractures require only short-term MMF. Displaced fractures require open reduction with rigid internal fixation (RIF).

Angle and Body

Fractures of the angle region (e.g., distal to the second molar but below the ascending ramus) are very common. They are usually caused by direct injury. Treatment is usually open reduction with rigid internal fixation but the use of MMF versus RIF varies in different clinical settings and in different geographic locations.

Parasymphysis

The parasymphysis is the area between the mandibular canines (the symphysis is the midline between the central incisors). A fracture is caused by direct injury. Treatment is complicated by muscle effects, and therefore displaced fractures require either open reduction or closed reduction with a lingual splint to prevent splaying of the inferior border when MMF is applied. Nondisplaced and nonmobile fractures can be managed with MMF alone for four to six weeks.

Midface Trauma

Although isolated midfacial and LeFort injuries occur, it is common to see multiple fractures that may involve several levels (Figure 5.13).

LeFort 1

In LeFort 1, the entire maxilla and palatine bones, up to the floor of the nose, extending from the anterior nasal spine to the pterygoid plates, is fractured in a

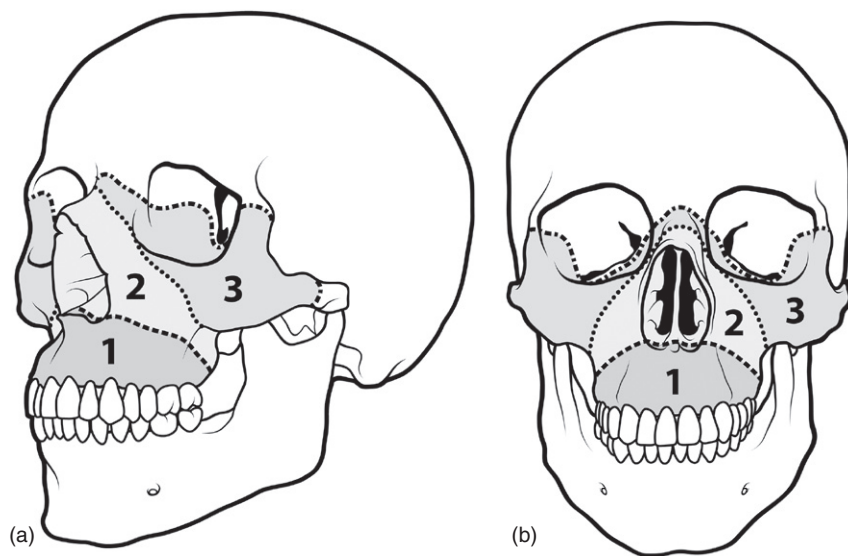


Figure 5.13. LeFort midface fractures.

horizontal manner. If minimal or non-mobile, MMF may suffice as treatment. If mobile, open reduction with rigid internal fixation is warranted.

LeFort 2

LeFort 2, also called a “pyramidal fracture” because of its triangular shape, crosses the maxilla obliquely from the pterygoid plates to the frontonasal area bilaterally. Thus, the maxilla moves at the level of the nasal bridge and infraorbital regions (zygomatico-maxillary suture). If displaced, treatment is open reduction with rigid internal fixation.

LeFort 3

LeFort 3 is also called “craniofacial dysjunction” because of the separation of the midfacial bones from the skull. This fracture begins at the pterygoid plates and involves the lateral orbital rim (frontozygomatic suture), zygomatic arch (zygomatico-maxillary suture), orbital floor, and frontonasal areas bilaterally. Thus, the entire face will move under the skull at the level of the orbits. Treatment requires open reduction with rigid internal fixation.

Zygomatic Arch

Zygomatic arch fractures are often the result of a direct blow. Fractures usually occur at the junction of the temporal process of the zygoma and the zygomatic process of the temporal bone. This can create the classic “W” fracture. Fracture of the zygoma proper will also involve this region but is usually linear and does not produce the “W.” Treatment usually involves popping the fractured arch out with a long, flat instrument via an intra-oral or extra-oral hairline (Gillie’s) incision.

Zygoma

A zygoma fracture is also called a “tripod” fracture because of its three clinically evident suture fracture lines (fronto-zygomatic, temporozygomatic, and zygomatico-maxillary). It results from a direct blow. The clinical findings are of great importance and include:

- Periorbital edema and ecchymosis
- Subconjunctival hemorrhage and ecchymosis
- Occasional entrapment of muscles with subsequent restriction of movement and diplopia
- Occasional displacement of Whitnall’s tubercle and the lateral canthus. Treatment begins with an ophthalmologic examination and, if displaced, usually requires open reduction with rigid internal fixation.

Soft Tissue Wounds

Oral and facial lacerations are a common presentation in the emergency department. Diagnosis and management are usually simple and uncomplicated, but patience and care are needed to ensure good functional and cosmetic results and to avoid or minimize damage to vital structures.

Assessment

Because lacerations indicate some form of traumatic injury, perform a complete evaluation with special emphasis on neurologic or cervical spine injury. Following this, evaluate for the following:

- **Magnitude of the laceration:** With or without anesthesia, gently probe the wound. Extensive or complicated wounds may often be better managed in an operating room (theater) if the tissue damage is great, if extensive debridement is needed, or if the patient is not, or cannot be, cooperative.
- **Appearance of the wound:** Irrigate and clean dirty or contaminated wounds thoroughly prior to closure. Particulate matter may require gentle scrubbing for removal. Crushed or non-vital edges should be revised by sharply excising a small amount of tissue from the margins.
- **Time sequence:** Increased time since the injury may increase complications such as infection and scarring. These wounds are preferably addressed within 12 hours of injury. Unlike lacerations of other areas of the body, the excellent blood supply of the face and oral cavity allows primary closure many hours after injury. In such cases, conservative debridement of the wound margins can often produce a more cosmetic result. In addition, high-velocity wounds (such as a shotgun injury) often undergo delayed tissue necrosis. It is sometimes necessary to clean and debride the wound initially and close it a few days later when the extent of tissue necrosis can be better assessed. If closure must be delayed, the wound should be grossly debrided, irrigated, and dressed with Xeroform™ gauze.
- **Damage to vital structures:** Examine for cranial nerve injury (especially branches of the facial nerve). If the ends of the nerve can be located but not primarily repaired, gently tag with a nonresorbable suture for later identification and grafting. Parotid duct injuries may be directly visualized or located by injecting 1 cc of half-strength methylene blue through a 20-gauge catheter passed into the Stenson's duct. Dye, filling the wound, indicates ductal injury and requires reconstruction and stenting. Tamponade large bleeding vessels until they can be isolated and ligated under proper and optimal conditions.
- **Cosmetic considerations:** Carefully evaluate large, jagged wounds that cross flexion creases or traverse critical anatomy (such as the vermillion border or eyelid).

Treatment

Closure may require alteration of the wound (e.g., Z-plasty) and, if extensive, may be better performed in the operating room under general anesthesia.

Anesthesia

If local anesthesia is to be used, this should be undertaken first with an anesthetic that is lasting and profound to accomplish good cosmetic and functional results. Lidocaine 2% with 1:100,000 epinephrine is usually an excellent choice with the exception of the tip of the nose and the pinna of the ear, where caution must be exercised not to cause tissue necrosis secondary to the vasoconstrictor. A sterile dental syringe or a standard 3- to 5-cc Luer lock and 25-gauge needle can be used to obtain a block injection, infiltration, or ring injection. Infiltrations may be performed either by injecting through the skin parallel and adjacent to the wound, or directly into the wound margins. It is usually best to insert the needle and then inject on the way out.

Preparation

When adequate anesthesia has been achieved, remove any obvious, large foreign bodies (e.g., large pieces of glass). Irrigate with large volumes of saline, lactated Ringer's or an antibiotic solution (but not sterile water because of its hypotonicity). The choice of solution is not as important as the volume (250 cc to 1 L, depending on the site of the wound) and the pressure used. Use a 50-cc syringe and an IV catheter (without the needle) placed directly into the wound. A pressure irrigator or water-jet lavage is particularly useful for grossly contaminated wounds. Next, clean the wounds with a surgical soap and irrigate again. Paint the wound with povidone-iodine solution for an area around the margins of at least 5 cm. Avoid the use of povidone-iodine tincture or scrub, because the alcohol in the tincture and detergent of the scrub can cause corneal ulceration if the liquid inadvertently enters the eyes. Place sterile towels (four, placed in a square fashion or a round hole cut into a disposable paper towel drape) to isolate the wound within the prepped area.

Hemostasis

The initial management for all heavy bleeding should be pressure with sterile gauze until the wound can be examined carefully under sterile, well-lit, well-equipped (e.g., suction available) conditions. Injudicious attempts at clamping vessels prior to this often leads to inadvertent damage to adjacent important structures. Large venous or arterial bleeders may be clamped with a mosquito hemostat and ligated (e.g., 4-0 chromic gut suture) or electrocoagulated. Intermittent packing of the wound for five minutes with moist gauze helps control profuse bleeding.

Debridement

Examine the wound carefully for any remaining dirt or foreign bodies. Excise any devitalized or necrotic soft or hard tissue. Remember, however, that the excellent blood supply of the face mandates that debridement be conservative. Remove only tissue that is obviously ischemic or necrotic. Also at this time, probe the wound to determine the extent of the injury and look for any unexpected findings such as:

- Fractures of the underlying bones
- Parotid or submandibular duct transection

- Nerve injuries
- Cartilage involvement in the ear and nose
- Tissue avulsion
- Injuries to the canalicular or nasolacrimal system, globe, or medial or lateral canthal ligaments, or lacerations that penetrate the tarsal plate of the eyelid

Abrasions and injuries resulting from being dragged along the ground require special treatment. After thorough examination for embedded foreign bodies, carefully scrub the wound using a soft brush (an operating room scrub brush/sponge works well) and a mild surgical soap solution. Remove all particles from the wound, regardless of size, to obtain good, long-term, cosmetic results.

Primary Repair of Lacerations

Choice of Suture Material There are two basic types of suture material: resorbable and nonresorbable. Resorbable sutures are used for closure of all tissues below the skin, for ligating small vessels, and for mucosal closure. Nonresorbable sutures are used for skin closure, for mucosal closure, and for ligating larger vessels. Sutures also can be monofilament or multifilament. Monofilamentous sutures are not generally as strong as multifilamentous but are less likely to convert contamination to infection by tracking bacteria into the wound. The choice of suture is based on:

- Location of laceration
- Desired time for tensile strength
- Ability and availability of suture removal

Choice of Suture Needle Four aspects of the suture needle influence selection.

- Shape: Three-eighths circle is the most popular. A half circle is easier to use in confined locations.
- Size: The diameter should match the suture size.
- Point: Cutting or reverse-cutting (the most popular), which are triangular in cross-section, are used in tough tissue (skin and mucosa). Taper-point needles are used in easily penetrated tissue.
- Method of attachment: Swagged needles are the most common in use but controlled-release (or pop-off) needles can be used for single stitches when easy removal of the needle from the operating environment is desired.

Choice of Suture Technique

- Simple deep suture: Used to close deep layers below the skin or mucosa. This is a simple, interrupted, resorbable suture such as Vicryl™ or Dexon™, or chromic gut (Figure 5.14). The technique begins with placement of the suture in a deep layer, followed by creation of a “surgical knot.” The “surgical knot” is created with two “throws” or passes of the knot clockwise, then one throw counterclockwise. This will seat and secure the suture. Finally, a third “throw” clockwise completes the surgical knot. Multiple deep sutures may be placed.

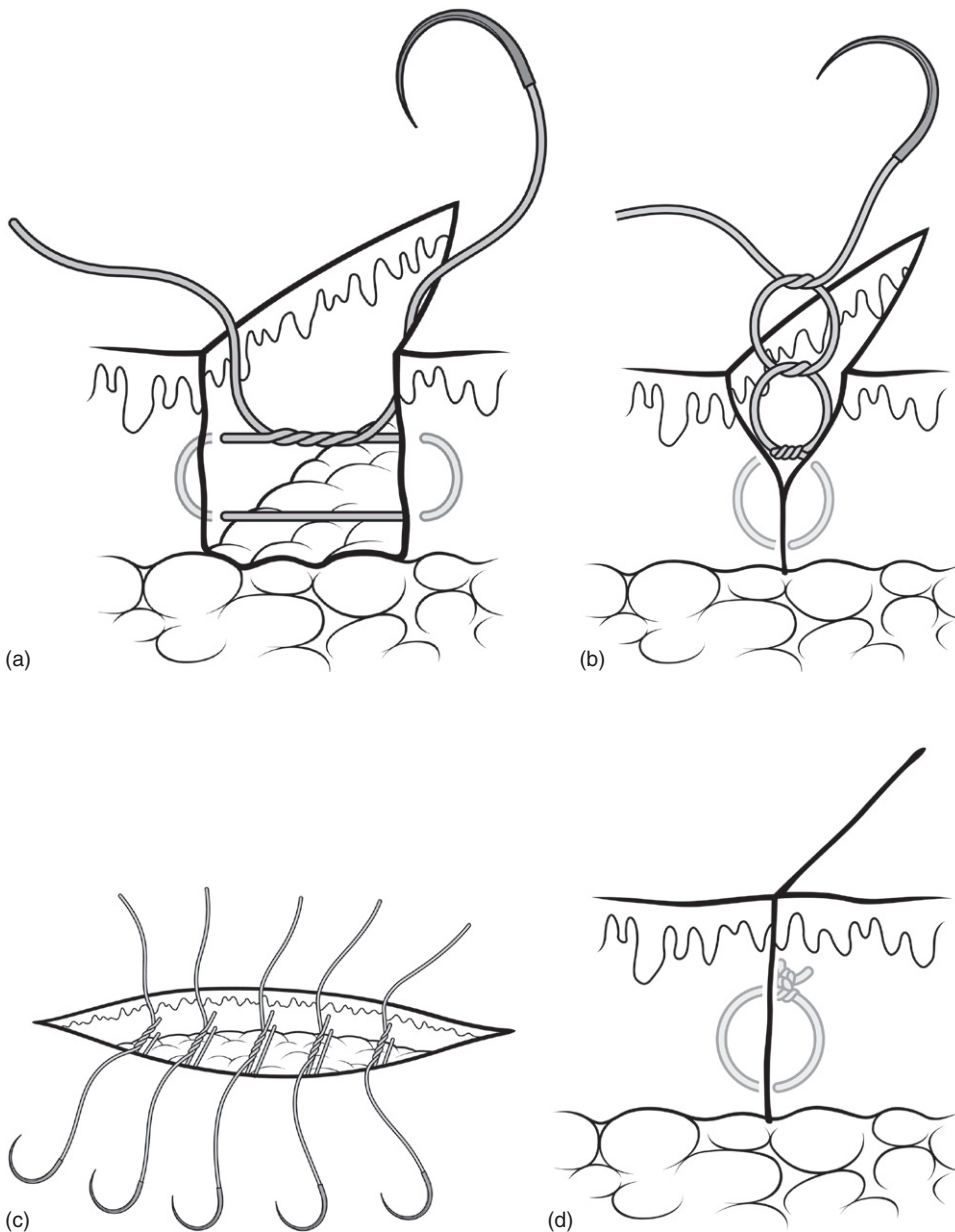


Figure 5.14. Simple, deep suture.

- **Inverted simple suture:** Placed so that the knot is deep to the loop of the suture. It is used to close the subcutaneous tissues so that the knot does not protrude through the wound. This closure is carried out just prior to skin or mucosal closure and is of great importance in obtaining a cosmetic closure (Figure 5.15). It is performed in the manner described about. The exception is that the knot is deep.
- **Running subcuticular suture:** A continuous suture placed in a horizontal fashion just below the epidermis. The ends are carried through the skin just beyond the

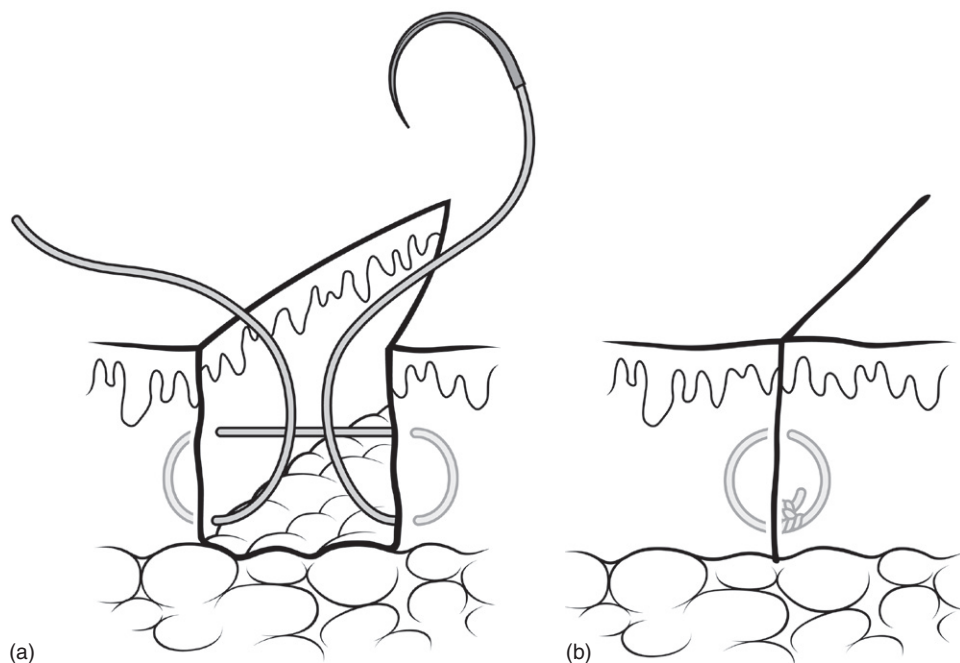


Figure 5.15. Inverted simple suture.

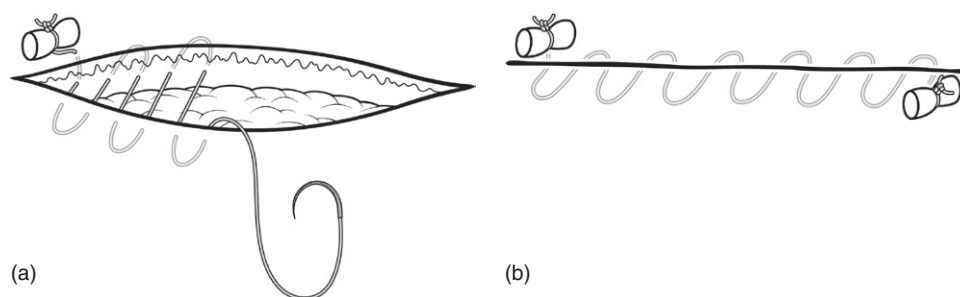


Figure 5.16. Running subcuticular suture.

extent of the wound and tied in a surgical knot. These are then either taped down or tied to a suture bolster (as illustrated). This method can be used as the final closure if skin sutures are not desired (Figure 5.16). Adhesive surgical tape strips (e.g., Steri-Strips™) may then be placed perpendicular to the laceration/incision. Adherence is best when an adhesive is also used.

- Simple interrupted skin suture: Used to close the skin or mucosa. Has the advantage that if an infection ensues, one or two sutures can be removed to allow placement of a drain without dehiscing the entire wound (Figure 5.17). Unfortunately, even under the best conditions, these will result in a less than cosmetic scar, having a “railroad track” or “Frankenstein” appearance.
- Vertical mattress suture: Placed so that there is a deep loop and a superficial loop that everts the skin edge. Most useful when eversion of skin edges is man-

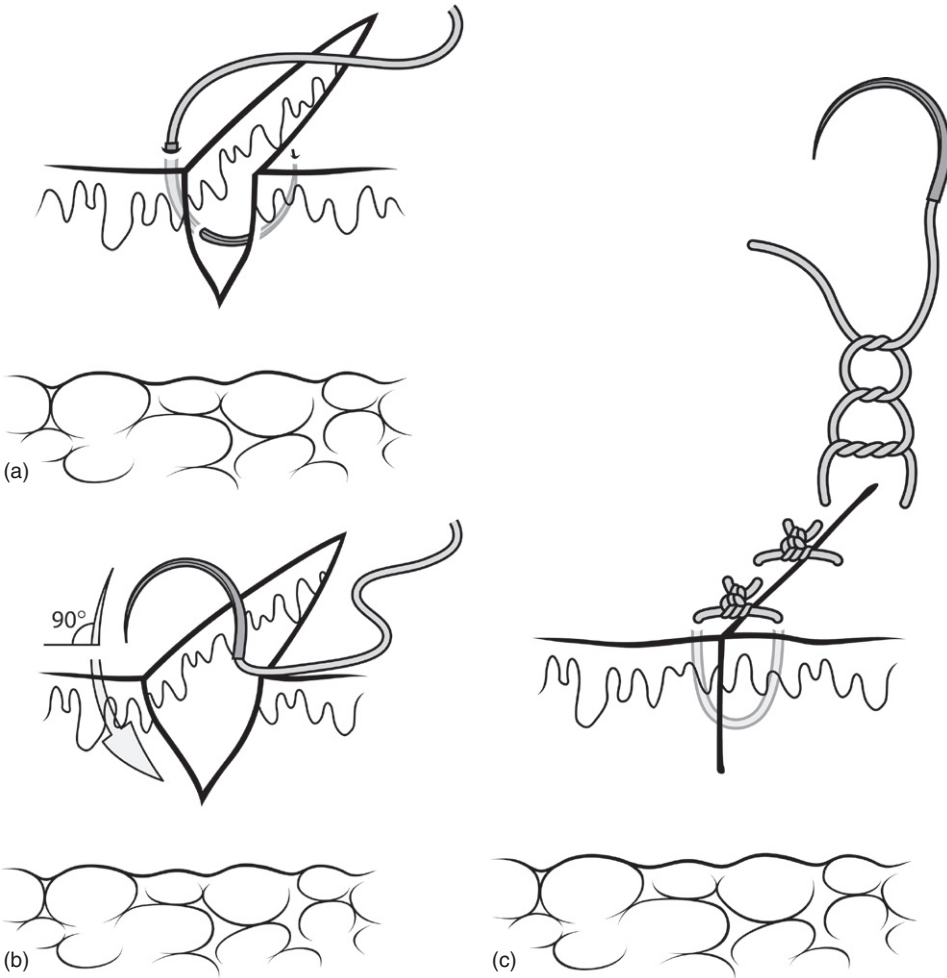


Figure 5.17. Simple interrupted skin suture.

dated or for single layer closure of large amounts of tissue (e.g., scalp lacerations) or when any tension of significance is placed on the wound (Figure 5.18).

- **Running epithelial suture:** A continuous skin suture used to obtain rapid final closure of the wound edges. Sometimes also called a “baseball stitch,” this technique works well on straight line wounds but is difficult with angled or curved wounds (Figure 5.19). It provides a less cosmetic result than the running subcuticular suture.

Standard Closure Technique for Facial Lacerations

- Close deep layers (e.g., periosteum, deep fascia) with resorbable suture (e.g., 3-0 Vicryl™ or Dexon™, or chromic gut) using a simple deep interrupted suture.

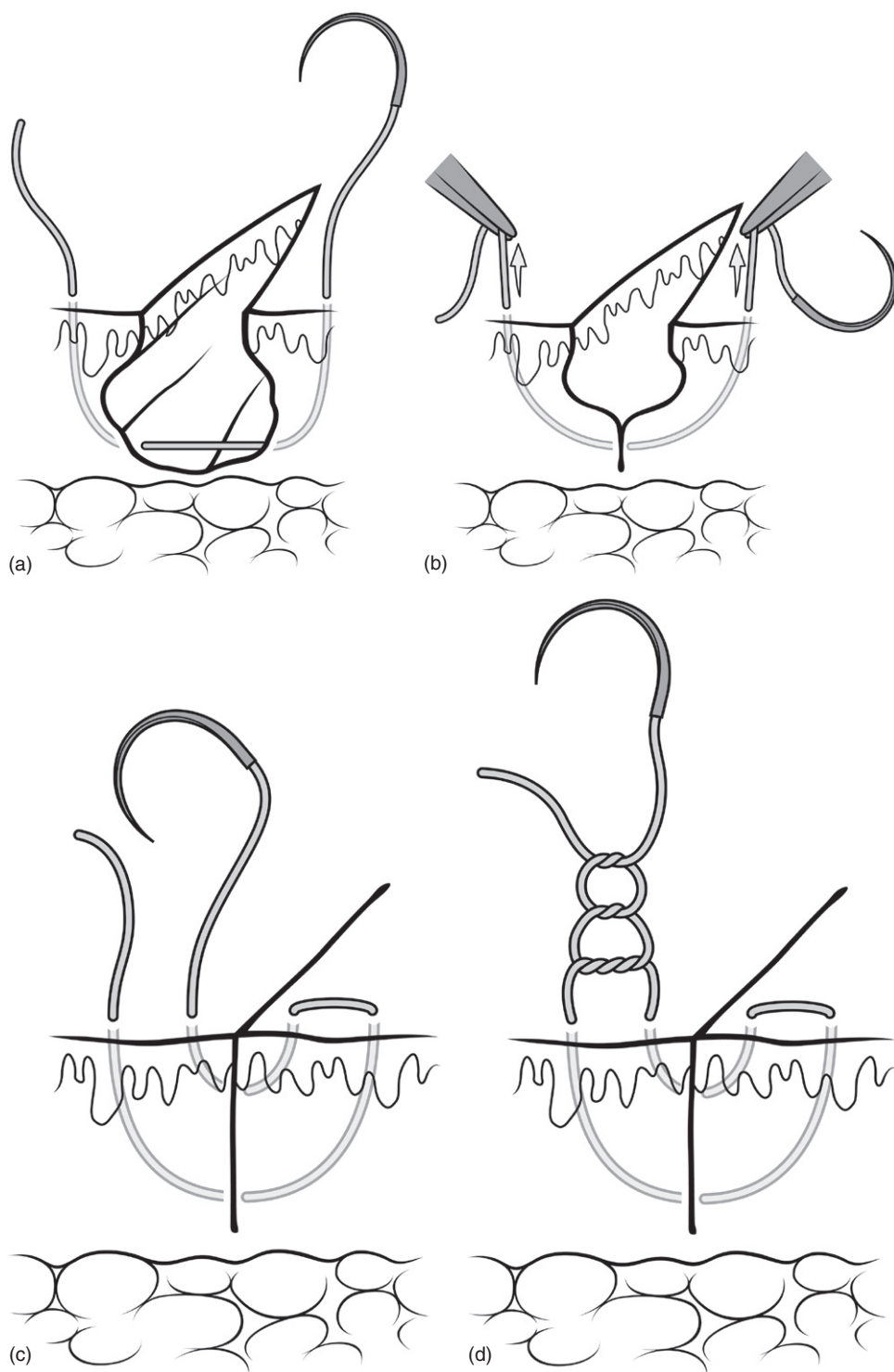


Figure 5.18. Vertical mattress suture.

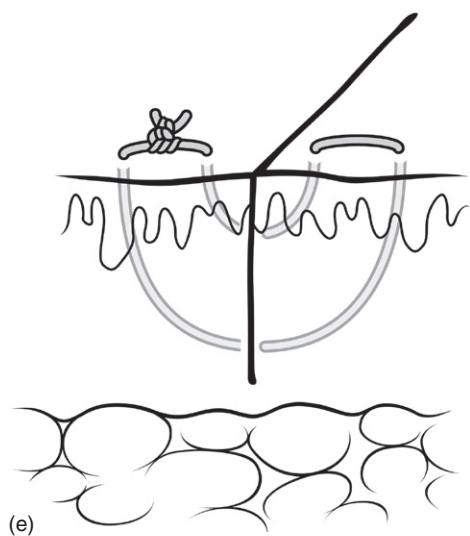


Figure 5.18. (Continued)

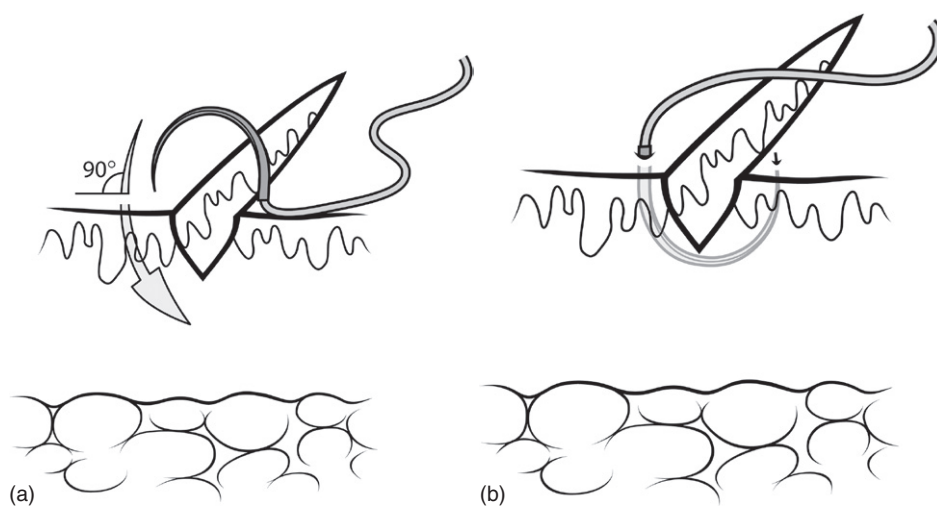


Figure 5.19. Running epithelial suture.

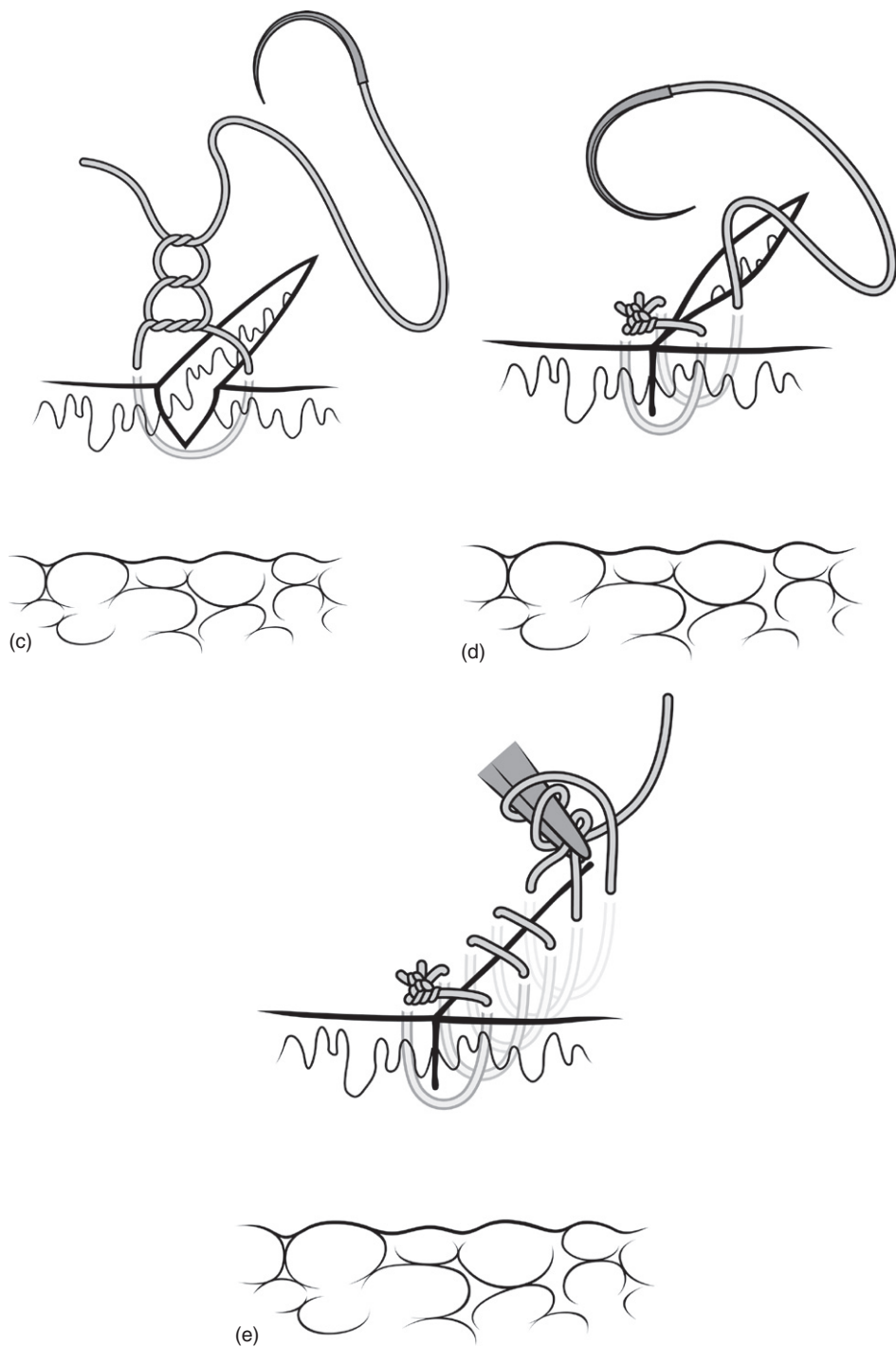


Figure 5.19. (Continued)

Close muscle by suturing together the fascia layer enveloping the muscle. Eliminate all dead space in layers to prevent hematoma formation (Figure 5.20).

- Close the subcutaneous layer with a resorbable suture as above but using an inverted simple suture. After tying the knot, pull the knot to one side to place it deep to the suture loop and thus out of the wound margin. The long-term strength of the closure is based on this layer of closure and it is, therefore, imperative to obtain excellent approximation of this layer. A suture that will retain its tensile strength for at least 21 days is also important.
- Close the skin at this point with a running subcuticular suture (e.g., 5-0 non-resorbable nylon or polypropylene suture such as Prolene™), a running skin suture (usually 5-0 or 6-0 nonresorbable suture), or multiple simple interrupted or inverted mattress skin sutures (usually 5-0 or 6-0 nonresorbable suture). This choice is based on personal preference, except for scalp lacerations, where a 4-0 nylon or polypropylene inverted mattress suture is preferred because it will engage the galea layer of the scalp, thereby providing additional strength to the wound closure.

Standard Mucosal Closure Technique

- Close deeper layers (e.g., periosteum and deep fascia) with resorbable sutures as for the skin closure.

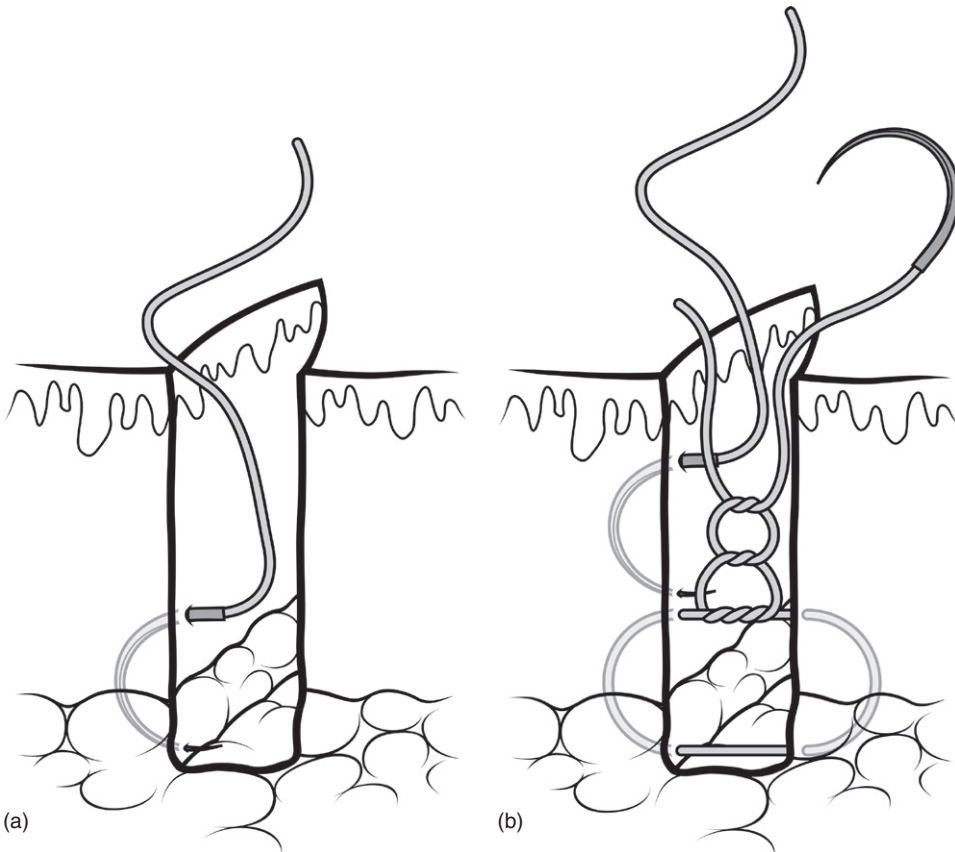


Figure 5.20. Standard closures technique.

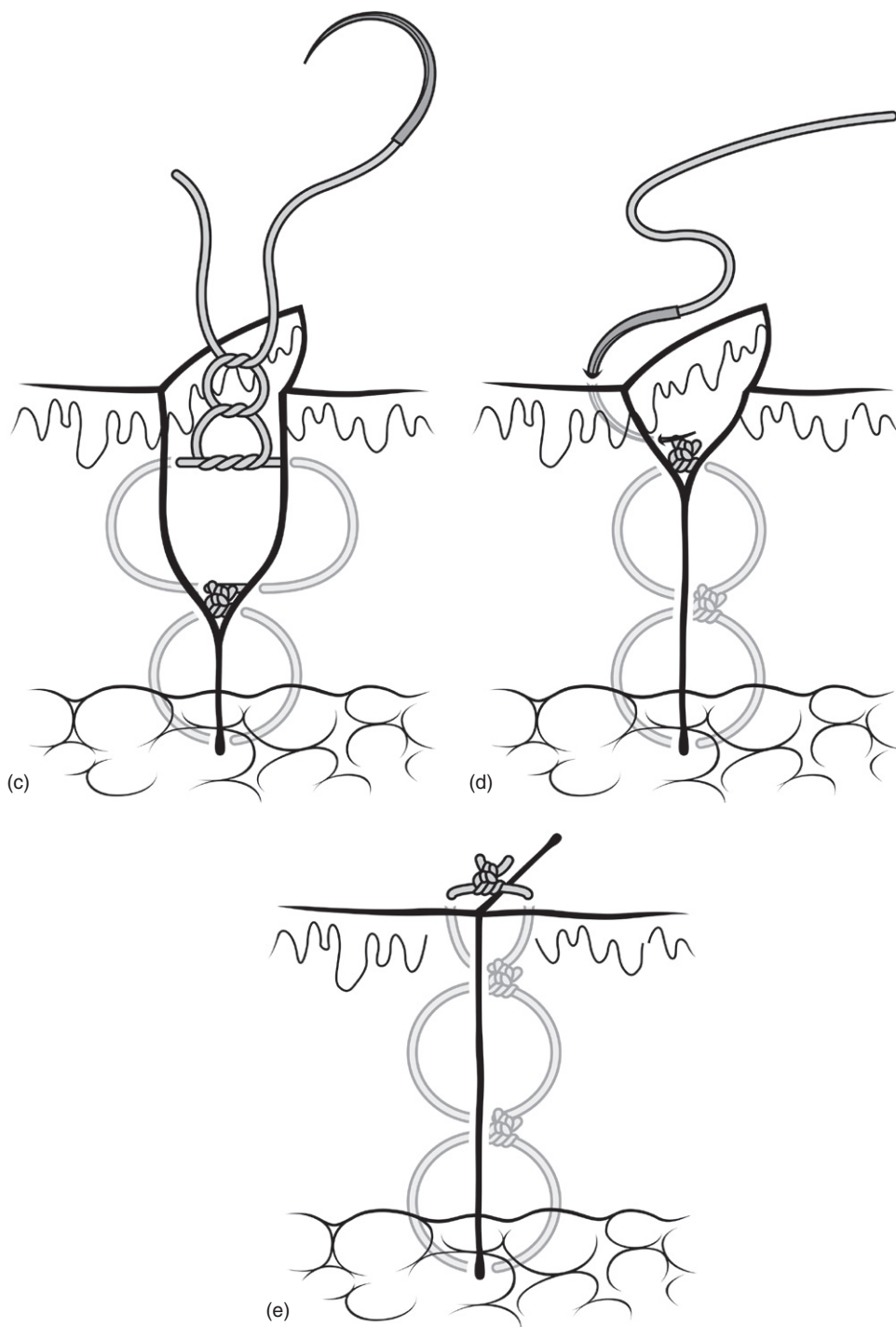


Figure 5.20. (Continued)

- There is usually no need for submucosal closure in the oral cavity.
- Close mucosa with either a nonresorbable suture (e.g., 3-0 or 4-0 silk or 5-0 nylon or polypropylene) or a resorbable suture (3-0 or 4-0 plain chromic gut, chromic gut, Vicryl™, or Dexon™).

Standard “Through and Through” (Mucosal–Epidermal) Closure

- After initial irrigation as usual, close the intra-oral mucosa in routine fashion. A watertight closure should be obtained, if possible.
- Then copiously irrigate the wound again from the extra-oral side and prep in the standard sterile fashion for a skin closure.
- Close the deep layers and skin as for a normal skin closure.

Unusual Circumstances

- When closing around lacerated cartilage (e.g., nose or ears), close the tissue deep and superficial to the cartilage to approximate the cartilage, if possible. Because of the lack of blood supply and therefore healing capacity of cartilage, a few PDS sutures may be placed in the cartilage to reassemble the anatomic shape and contours. Finally, the superficial soft tissues may be closed.
- Scalp wounds bleed profusely but will stop quickly once the galea is approximated. This can be done easily by using deep-bite vertical mattress sutures. Staples are very popular for scalp lacerations, especially for children.
- Avoid using electrocoagulation when suturing hair-borne areas (e.g., eyelid, scalp) because this will cause loss of hair follicles. Any incisions made to freshen the edges of the wound should be made very conservatively and along the long axis of the hair follicles (e.g., not necessarily perpendicular to the wound margin) to prevent loss of the follicle.
- Never shave around the eyebrows to better visualize a laceration. Eyebrows do not always grow back!
- Always approximate important anatomical structures first (e.g., eyebrow, commissure, or vermillion border of lip). This should be done with tacking sutures even prior to subcutaneous closure to allow for proper alignment.
- Other than scalps and eyebrows, convert beveled wounds to perpendicular margins to avoid raised areas after healing.
- With jagged wounds it is usually better to convert the wounds to several linear portions by conservative excision.
- To obtain primary closure without tension, the wound may be undermined by piercing the deep subcutaneous tissue with sharp scissors and then opening them as the instrument is withdrawn from the wound. Separation of these layers allows the skin to “slide” on the underlying tissues and aids in easy closure.

Postoperative Care

- Wound dressing: Wipe the wound with saline-soaked gauze after final suturing to remove any residual blood, suture material, or iodine. Place a thin layer of

an antibiotic ointment on the suture line and cover it with a non-sticky dressing (e.g., Telfa™, Xeroform™, or Melolin). Intra-oral wounds require no special dressing.

- Leave skin wounds alone for 48 hours. Following this, they should be cleaned gently twice daily with warm water and soap or hydrogen peroxide to remove any crusted blood or other debris. It is important to remove dried blood and debris around the sutures. Follow this with another layer of antibiotic ointment. Rinse intra-oral wounds with saline several times per day.
- Antibiotic coverage: As with all infections, the choice of antibiotic therapy should be guided by culture and sensitivity testing. Prophylactic coverage for dirty lacerations, however, may be initiated with the following:
 - Deep or dirty skin wounds: *Staphylococcal* coverage is warranted and provided by a cephalosporin (Appendix 12, Table A12-4).
 - Intra-oral wounds: Penicillin or, if penicillin allergic, erythromycin (Appendix 12, Table A12-4). Older or infected wounds are often colonized by anaerobic organisms and are sometimes better treated by adding metronidazole to the penicillin or switching to clindamycin.
- Tetanus prophylaxis: Consider any patient with a laceration of traumatic origin for the appropriate tetanus therapy.
- Suture removal:
 - Remove intra-oral, nonresorbable sutures or resorbable sutures that are uncomfortable five to nine days after placement.
 - Skin sutures should be removed at different times depending on the thickness of the tissue, type of closure, and degree of tissue tension.

In general, nylon facial sutures are removed at four to six days. Nylon sutures in the eyelids, ears, nose, or other thin tissue should be removed at three to five days. Running subcuticular sutures may be left an additional day or two without consequence.

Temporomandibular Joint (TMJ) Emergencies

True TMJ emergencies are rare, but condylar dislocation is not uncommon.

Acute Condylar Dislocation

History

- Sudden inability to close the mouth
- Precipitating event is usually wide mouth opening, as during a yawn or trauma. May be related to emergent intubation in the emergency room or operating room
- Can be unilateral or bilateral (but is most often bilateral)
- Often has history of chronic recurrence
- May or may not be painful

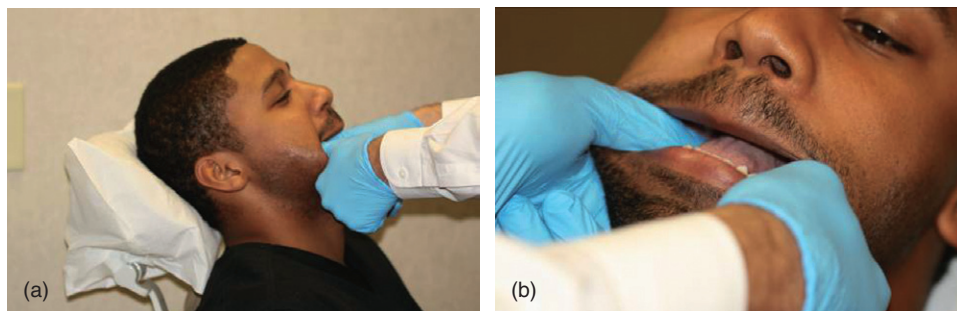


Figure 5.21. (a) Stand in front of the patient, whose head is against the headrest. (b) Place thumbs on the oblique ridges to avoid rapid closure of the teeth against the thumbs. Gently push the thumbs down on the external oblique ridges or posterior molars, while lifting the symphysis. This will torque the mandible about an axis revolving around the junction of the angle and ascending ramus. Continue lifting the symphysis while stabilizing the axis with the thumbs until the condyle reseats within the condylar fossa.

Examination and Diagnosis

- Anterior open bite, which may be asymmetrical if unilateral
- Panoramic or lateral oblique of mandible shows condyle(s) anterior to the articulating eminence

Treatment

- Stand in front of the patient. Place thumbs bilaterally along the external oblique ridges or posterior teeth of the mandible with the forefingers under the symphysis of the mandible (Figure 5.21).
- Gently push the thumbs down on the external oblique ridges or posterior molars, while lifting the symphysis. This will torque the mandible about an axis revolving around the junction of the angle and ascending ramus. Continue lifting the symphysis while stabilizing the axis with the thumbs until the condyle reseats within the condylar fossa.
- If bilateral, this should be done simultaneously and synchronously.
- If unable to reduce, perform the same maneuver from behind the patient. A stool may be required for the dentist to stand on.
- If this fails, the patient should be brought to the operating room, paralyzed, and reduced.
- Limit function and wide opening of the jaw for two weeks. Massage of the muscles of mastication and muscle relaxing medicaments are helpful.

Acute Myofascial Pain

History

- Acute but diffuse pain in muscles of face, neck and head
- Limitation of mandibular motion

- Difficulty eating
- Often related to acute stress

Diagnosis

- No radiographic evidence of joint pathology
- Pattern of diffuse, nonlocalized pain
- Pain on masticatory muscle palpation
- May see mandibular deviation on opening

Treatment

Generally aimed at breaking muscle spasm, stress reduction, and acute pain relief:

- Anti-inflammatory agents (Appendix 12, Table A12-4)
- Warm compresses to face six to eight times per day
- Soft, non-chewy diet
- Consider muscle relaxants
- Stress reduction
- Consider 1 to 1.5 cc lidocaine without vasoconstrictor injected into trigger areas

Traumatic Hemarthrosis or Joint Effusion

History

- Recent trauma to mandible
- Limitation of opening
- Acute joint pain
- Patient complains of “bite” being off

Diagnosis

- Acute posterior open bite and/or malocclusion on affected side
- May have edema in the joint region
- No radiographic evidence of fracture
- May see increased articular space on radiograph

Treatment

- Soft diet and limited functioning for a week
- Ice to the area for first 24 hours, then warm compresses six to eight times per day

- Anti-inflammatory agents
- Reassurance and observation for improvement

Suggested Readings

Medicolegal Aspects of Emergency Care

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Emergency Department Medical Records

Bickley LS, Robert A, Hoekelman RA, Bates B (Eds.). Bates' Guide to Physical Examination and History Taking. Lippincott, Williams and Wilkins, New York. 2008.

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Daniel M, Laskin DM, Strauss RA. Current Concepts in the Management of Maxillofacial Infections. Oral and Maxillofacial Surgery Clinics of North America. Volume 15, Issue 1. Feb. 2003.

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TMJ Emergencies

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6 Medical Emergencies

True medical emergencies in the dental office are rare and usually related to the complexity of the patient's medical history, the difficulty of the dental procedures being performed, and the method of anesthesia/analgesia employed. Many are avoided if recognized early on, although some may require rapid and specific intervention when they arise. Vasovagal syncope is by far the most common medical "emergency" to occur in the dental office. It is less common in children than in adults. Less frequent, but of increased significance, are cardiovascular emergencies such as angina and acute myocardial infarction. Other important problems include hypertensive crisis, grand mal (generalized tonic-clonic) seizures, hypoglycemia, asthma, airway obstruction, anaphylaxis, and overdose of local anesthetic.

A thorough medical history and physical examination prior to the performance of the procedure are the keys to the identification of medical illnesses, the assessment of their severity, and the prevention of adverse events through appropriate preoperative preparation. For example, a patient with severe asthma may have a history of episodic high dose steroid use (Appendix 12, Table A12-1). This history, along with the assessment of the pulmonary status and ability to withstand an intravenous sedation or general anesthetic, provides valuable information for the treating clinician. This history of steroid use may lead to adrenal compromise with associated cardiovascular collapse under stress, which can be avoided with the appropriate prophylaxis.

The vast majority of medical emergencies in the dental office can be avoided by a good history and physical assessment and appropriate preoperative preventative measures. The medical complexity of the patient, the equipment available for management of the medical problem, and the actual management are all based upon the individual practitioner's specific education, training, and scope of practice. The overview to follow is presented in both general and specific terms to provide readers

with varying degrees of expertise and training a meaningful synopsis of the management of the most common medical emergencies in the dental setting. The use of algorithms is meant to provide an ordered, simple, step-by-step sequence for the management of these problems in a manner that provides clarity and priority in times of stress for both the patient and the practitioner.

Please refer to Appendix 12, Table A12-12 (Emergency Medications and Equipment), and Appendix 13 (Emergency Room Kit) at the end of this book.

Syncope

Syncope is the most common medical emergency in the dental setting. It can be the result of psychological stress (e.g. fear, pain, sight of blood), hypoglycemia, and pre-existing cardiovascular disease. Patients may describe nausea, light-headedness, blurry vision, and flushing. If the patient is attached to a cardiac monitor and sphygmomanometer, a syncopal episode, when witnessed, will be preceded by a brief episode of tachycardia, followed by bradycardia, hypotension, and a period of unconsciousness (Figure 6.1). Seizures and a postictal state immediately after syncope may be seen. Most syncopal episodes occur with unmonitored patients and thus the bradycardia, hypotension, and unconsciousness are the first signs and symptoms elicited, and all too frequently, it is the unconsciousness of the patient that is first noted.

Vasovagal Syncope

Psychological stress (fear, pain, sight of blood, illness) leads to increased vagal stimulation, venous pooling, and bradycardia. The result is decreased cerebral perfusion and loss of consciousness (Figure 6.2). This is the most common cause of

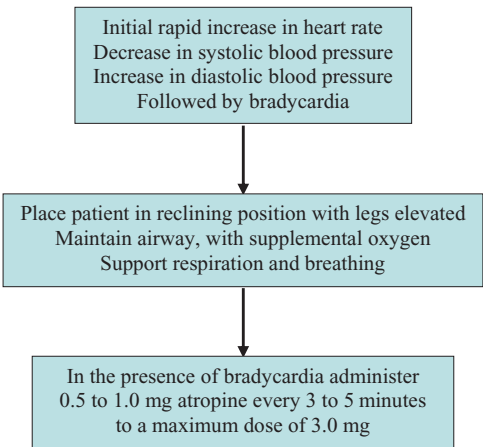


Figure 6.1. Syncope.

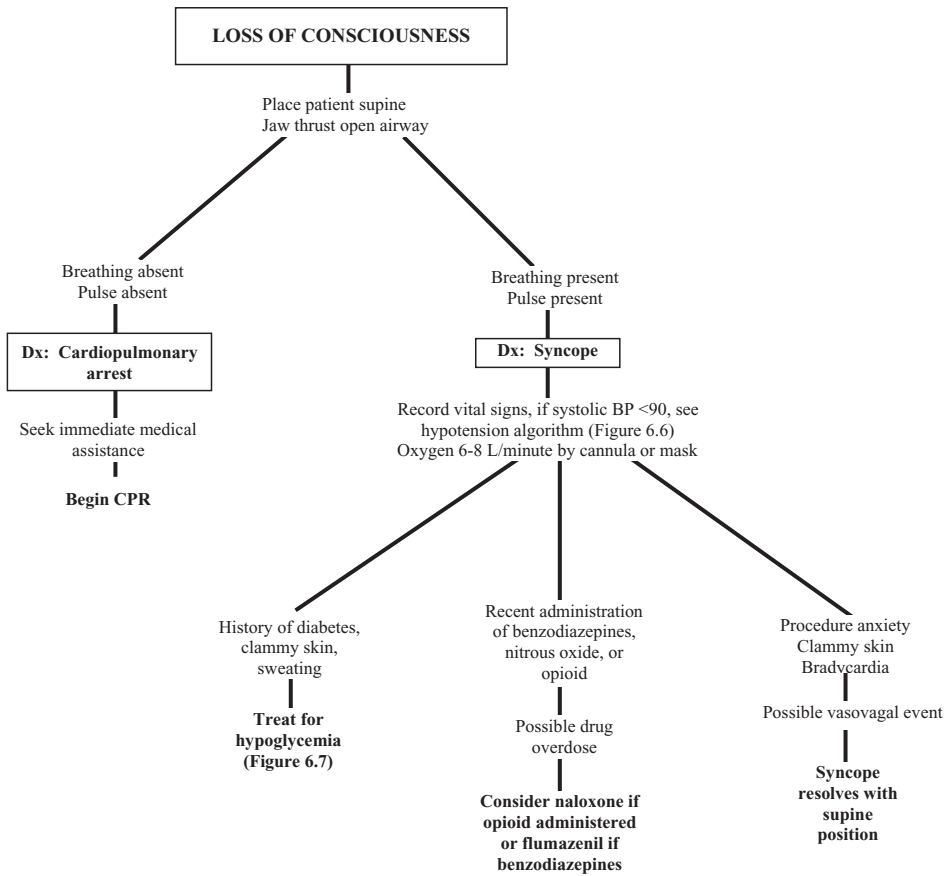


Figure 6.2. Evaluation of loss of consciousness.

syncope in adults in the dental surgery. Fifty percent of people have experienced syncope.

Signs and Symptoms

- Pallor, flushed feeling, sweating, nausea, vomiting
- Weakness
- Light-headedness
- Dimming of vision
- Bradycardia
- Hypotension
- Brief unconsciousness

Treatment

- The management for syncope is supportive.
- Check for adequate pulse and respirations.

- Patient should be placed in Trendelenburg position (supine with feet elevated and head low). Pregnant females should be placed on their left side to prevent compression of the inferior vena cava.
- Loosen shirt collar to decrease carotid sinus stimulation.
- Provide oxygen at a flow of 6 to 8L/minute by mask or nasal cannula.
- Aromatic spirits of ammonia placed into the nostril for five seconds should elicit a response in patients with vasovagal syncope.
- Blood pressure and pulse should be obtained. If blood pressure is less than 90 mmHg systolic, the patient should be treated as for shock.
- Syncope should resolve when the patient assumes the supine position. This is occasionally accompanied by brief (two to three seconds) tonic-clonic movements of the extremities.
- If the patient remains hypotensive, a fluid challenge may be provided (see the section of hypotension to follow) and atropine administered if intravenous access and medication administration is within the practitioner's scope of practice.
- Once the episode appears to have resolved, be aware that the cardiovascular system does not fully recover for more than 30 minutes. There is the potential for the patient to have another syncopal episode if the dental procedure proceeds, and this prolonged recovery needs to be taken into consideration when the patient leaves the office.

Respiratory Difficulty

Numerous conditions result in respiratory difficulty. The key to management is to assess the patient while providing supportive care, to arrive at a diagnosis, and then to manage the patient based upon that diagnosis. For a patient who is short of breath, the algorithm in Figure 6.3 can help to triage the patient.

Pulmonary Edema

Pulmonary edema is the accumulation of fluid within the air spaces and parenchyma of the lungs. It generally leads to impaired gas exchange and may cause respiratory failure. It may be due to either the failure of the left ventricle of the heart to adequately evacuate blood from the pulmonary circulation, or from an injury to the lung parenchyma or pulmonary vasculature. There are multiple causes and the treatment is directed at improvement of the symptoms, correcting the etiology of the edema, and avoiding further damage to the lung. Pulmonary edema, especially in the acute setting, can lead to respiratory failure, cardiac arrest due to hypoxia, and death.

Signs and Symptoms

Pulmonary edema is precipitated by high blood pressure, myocardial infarction, arrhythmias, or noncompliance with medications. Manifestations include anxiety, dyspnea, sweating, tachycardia, and cyanosis. Lethargy is an ominous sign.

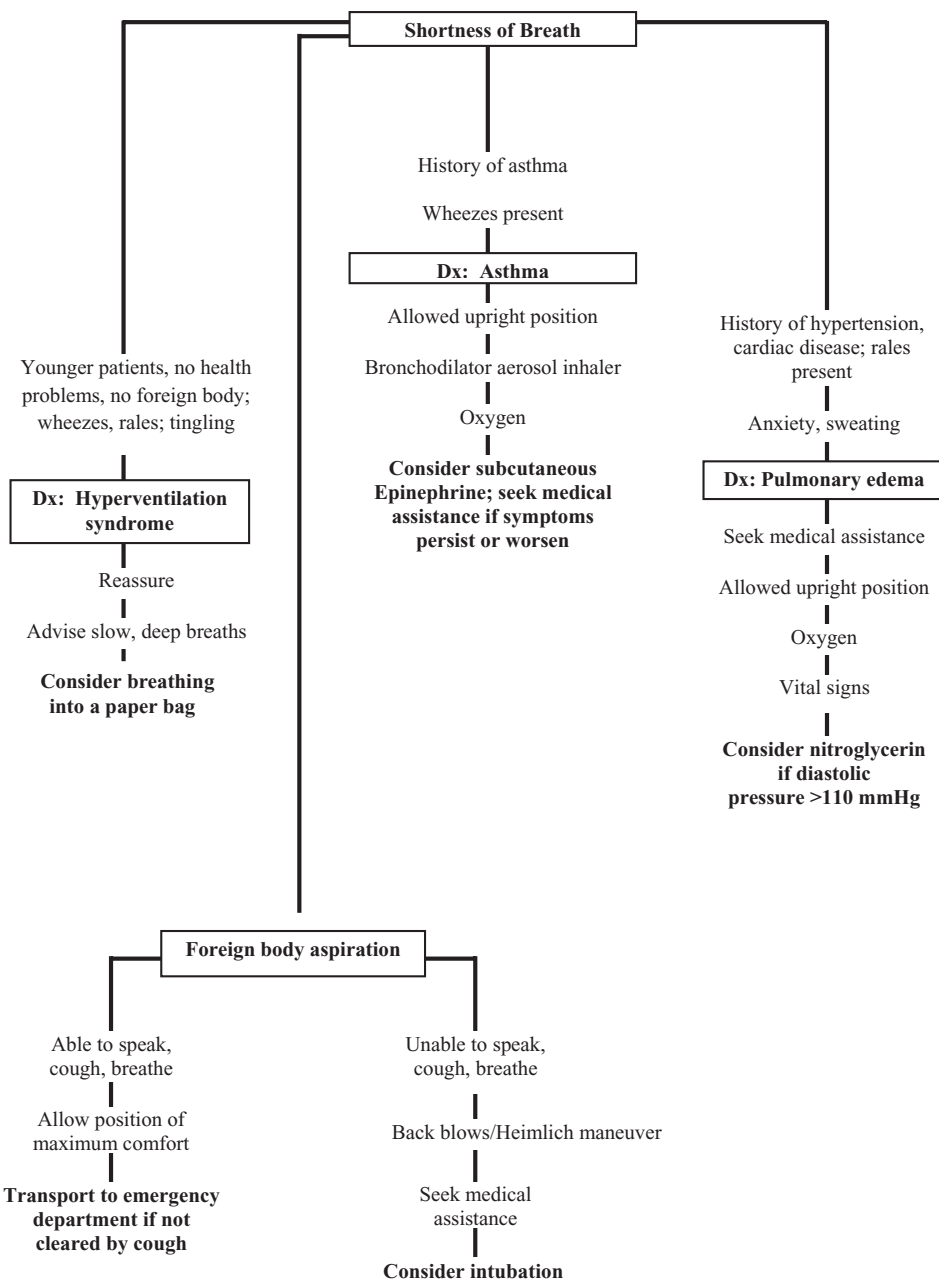


Figure 6.3. Evaluation of shortness of breath.

Treatment

- Medical assistance should be sought.
- The patient should be allowed to assume the position of maximum comfort, commonly upright.
- Oxygen 10L/minute by oxygen reservoir mask should be administered. Use simple mask or nasal cannula if reservoir mask is unavailable.
- Vital signs should be obtained. Give sublingual nitroglycerin if diastolic blood pressure is above 110mmHg.

Foreign Body Obstruction

If the Patient Can Speak, Cough, and Breathe

- Do not interfere. Allow the patient to assume the position of maximum comfort.
- If the foreign object is not cleared by coughing, the patient should be transported to an emergency department for further management.

If the Patient Is Unable to Speak, Cough, and Breathe

When managing patients in a dental setting, there are a number of circumstances that can cause an airway obstruction. Over-sedation and the posturing of the patient's tongue, displaced dentures, cotton gauze, rubber dam, displaced teeth, dental instruments, overzealous irrigation, and even angioneurotic edema may cause some form of airway obstruction. The key to management is prevention through vigilance. Monitor the patient (and the airway) periodically. Keep track of instrumentation and irrigation. Be aware of the patient's medical history.

The management of an airway obstruction begins with recognition of the signs and symptoms, which include gurgling, stridor, difficulty breathing, and/or the absence of the sounds of a patent upper airway (Figure 6.4). The oropharynx should

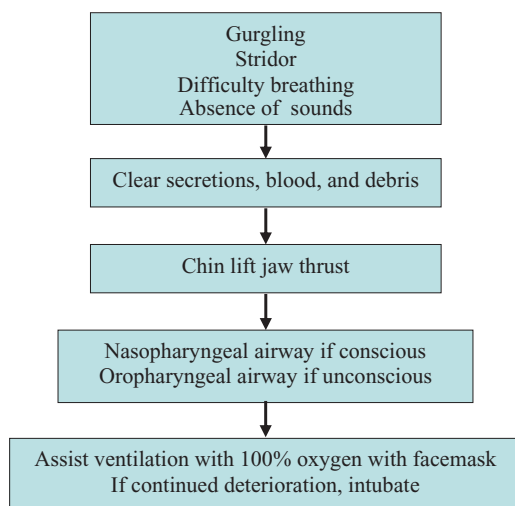


Figure 6.4. Airway obstruction.

be inspected for foreign material and any secretions, and if present they should be removed and the mouth suctioned dry. If foreign material, secretions, or irrigation are not identified, the jaw should be anteriorly repositioned until the anatomic obstruction (tongue) is eliminated. For an unconscious patient, airway assistance with a nasopharyngeal or oropharyngeal airway may provide ventilatory assistance. Supplemental oxygen should be provided. For further deterioration, intubation may be required if it is within the practitioner's scope of practice.

Asthma

Medical History

Obtain a detailed medical history prior to treatment. Try to determine:

- Age of onset
- Precipitating factors (recent respiratory infection, seasonal change, allergies, exercise, pollutants, anxiety, stress, certain medications [salicylates, NSAIDS, cholinergic drugs, beta-adrenergic blockers], certain foods [milk, nuts, shellfish, strawberries, tartrazine food dye])
 - In children, the primary type of asthma is allergic or extrinsic asthma which is most often triggered by specific allergens such as pollen, dust, and molds
- Frequency and severity (i.e., mild, moderate, and severe); last attack and its duration and the history of hospitalization (e.g., frequency)
- Current medications and compliance: Medication administration, frequency of oral steroid use, and history of intubation can be used to assess disease severity (Appendix 12-12)
- History of hypersensitivity to aspirin and nonsteroidal anti-inflammatory Drugs (NSAIDS)
- Family history of asthma, allergy, or other atopic disorders

Signs and Symptoms of an Asthma Attack

- Expiratory wheezes and prolonged expiratory phase (expiration normally twice as long as inspiration)
- Shortness of breath, tachypnea (Figure 6.3)
- Pressure on chest
- Nonproductive cough
- Increased respiratory effort (prominent neck muscles, nasal flaring, increased chest and abdominal movement); usually sitting upright, leaning forward
- Rapid pulse
- Apprehension
- Cyanosis (severe cases)

Prophylaxis

- Bronchodilator aerosol inhaler: The patient should bring the inhaler to the dental office and have it accessible to staff. The patient might want to take a puff just before the procedure.

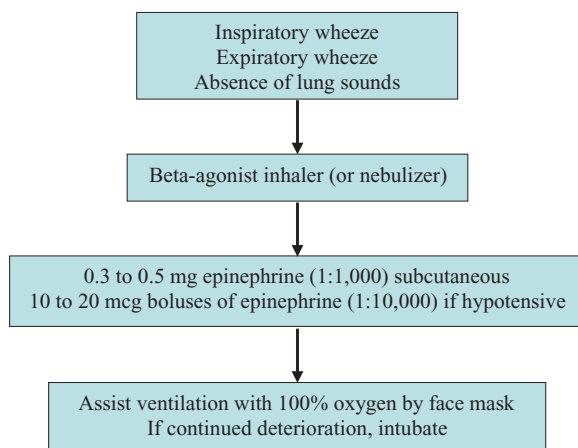


Figure 6.5. Bronchospasm.

- Oral antiasthmatic medications: The patient should be instructed to take medication as usual, if on a daily dose (Appendix 12, Table A12-1).
- Medications to avoid:
 - Aspirin and NSAIDs
 - Sedating medications due to depression of the central nervous system and impaired respiratory drive exacerbating respiratory distress during acute asthma attacks

Treatment

When managing the asthmatic in acute distress, it is the bronchospasm that needs to be addressed (Figure 6.5). Yet, it must also be remembered that aspiration of a foreign body or particulate matter can also induce a bronchospasm.

An acute asthma exacerbation or attack will present with respiratory distress and expiratory wheeze. Many asthmatics recognize their symptoms early on and can be of invaluable assistance in managing their own attacks. Immediate bronchodilation with inhaled beta-agonist bronchodilators is the first line of therapy and should result in partial to complete easing of the wheeze and shortness of breath. If there is little to no response to the bronchodilation, medical assistance should be sought urgently as an asthma attack can quickly turn into a life-threatening emergency requiring intubation.

Hyperventilation Syndrome

Hyperventilation syndrome may present as acute respiratory distress with a broad range of associated symptoms such as light-headedness, dizziness, nausea, chest pain, or shortness of breath. Hyperventilation is often associated with extreme anxiety occurring during periods of intense fear or apprehension. Commonly referred to as a “panic attack,” these episodes affect individuals differently. Fear of the dentist, the patient’s perception that he or she is having a heart attack or a

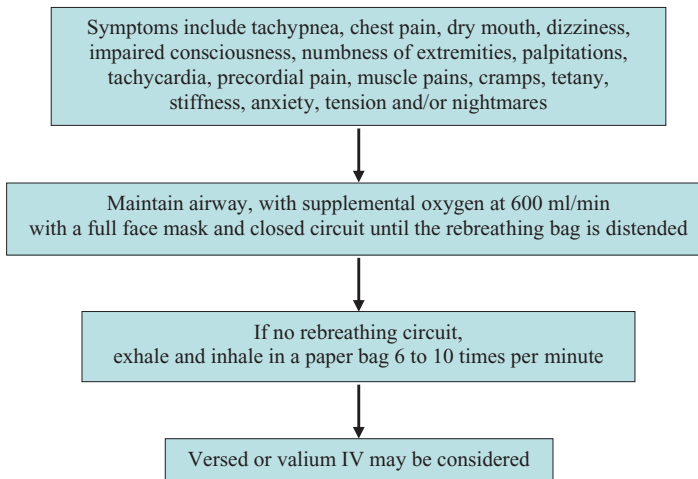


Figure 6.6. Hyperventilation syndrome.

“nervous breakdown,” or other worries can all precipitate this type of event. Many patients have symptoms associated with the “fight or flight” response of the sympathetic nervous system such as tachycardia, tachypnea, diaphoresis, dry mouth, dizziness, impaired consciousness, tingling of the extremities, and a variety of other symptoms (Figure 6.6).

The management of hyperventilation begins with reassurance, with calm maintenance of an airway and provision of supplemental oxygen. Patients can be encouraged to use a rebreathing ventilatory circuit or paper bag to permit carbon dioxide to increase in the blood serum. For the individual who is having an uncontrolled or prolonged anxiety attack, intravenous diazepam or midazolam is helpful, if the administration of intravenous medication is within the practitioner’s scope of practice.

Laryngospasm

During the era that methohexital was the mainstay of ambulatory dental general anesthesia, laryngospasm was an “everyday” event. It still can occur when modern sedative and general anesthetic medications obtund the patient and the laryngeal structures are stimulated by the water used in irrigation, or foreign substances such as a tooth fragments, restorative material, prostheses, or instruments are displaced into the pharynx.

Laryngospasm must be identified rapidly. The practitioner will note increased respiratory effort when air exchange becomes difficult, the presence of high pitched “crowing” sounds if a partial laryngospasm exists, or a total absence of sounds if a complete laryngospasm occurs (Figure 6.7). The airway should be maintained and respirations supported. The mouth and oropharynx should be inspected for foreign substances that should be removed via suction, digital manipulation, or with a McKesson forceps. If the provision of intravenous medication and intubation is

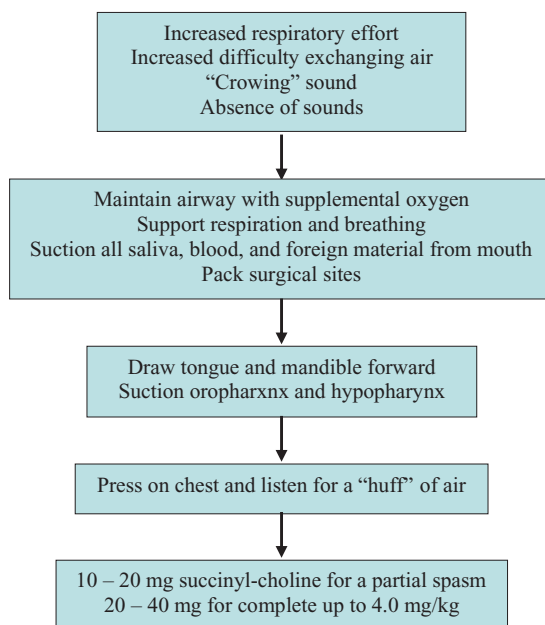


Figure 6.7. Laryngospasm.

within the practitioner’s scope of practice, then succinyl-choline should be administered. If no response is elicited, emergency management is necessary. Emergency medical services (EMS) should be summoned if in an office setting, or a “code” called if in a hospital outpatient or inpatient setting.

Cardiac and Vascular Emergencies

Cardiac Emergencies

The subject of cardiac emergencies and their complete management is beyond the scope of this publication. The reader is directed to the American Heart Association’s courses in Emergency Cardiovascular Care for Healthcare providers for a review of the definitive management of these problems. These guidelines are updated periodically and may be revised prior to a revision and reprinting of this book. The intent of this text is to provide dental practitioners with varying levels of training and scope of practice, with a simple, step-by-step, sequential approach to the evaluation and management of cardiac emergencies in order to provide the best outcome for the patient. The perspective taken is for assessment, stabilization, and transport until the appropriate expert can intervene. No matter how extensive the dental practitioner’s scope of practice may be, complex cardiac problems, cardioversion, and the use of complex anti-arrhythmic medications are best managed in an emer-

gency room or inpatient setting, and not in a dental office or hospital dental outpatient facility.

Acute coronary syndrome (ACS) is a term used to refer to a constellation of symptoms caused by occlusion of coronary arteries. These range from angina to myocardial infarction (MI) and can be life-threatening if appropriate management is not begun immediately. All patients with a history of coronary artery disease or risk factors such as diabetes, hypertension, hypercholesterolemia, and smoking should be identified prior to procedures. History of past cardiac events, current medications, and known symptoms help alert the practitioner to any possible risk of an event during the procedure. Signs and symptoms of ACS can include mild to “crushing” chest pain “like an elephant is sitting on my chest,” with or without associated radiation down the left arm, into the jaw, or back; shortness of breath, diaphoresis, and other signs of distress. Diabetic patients and women may present with milder, “atypical” symptoms such as gas or indigestion (Figure 6.8).

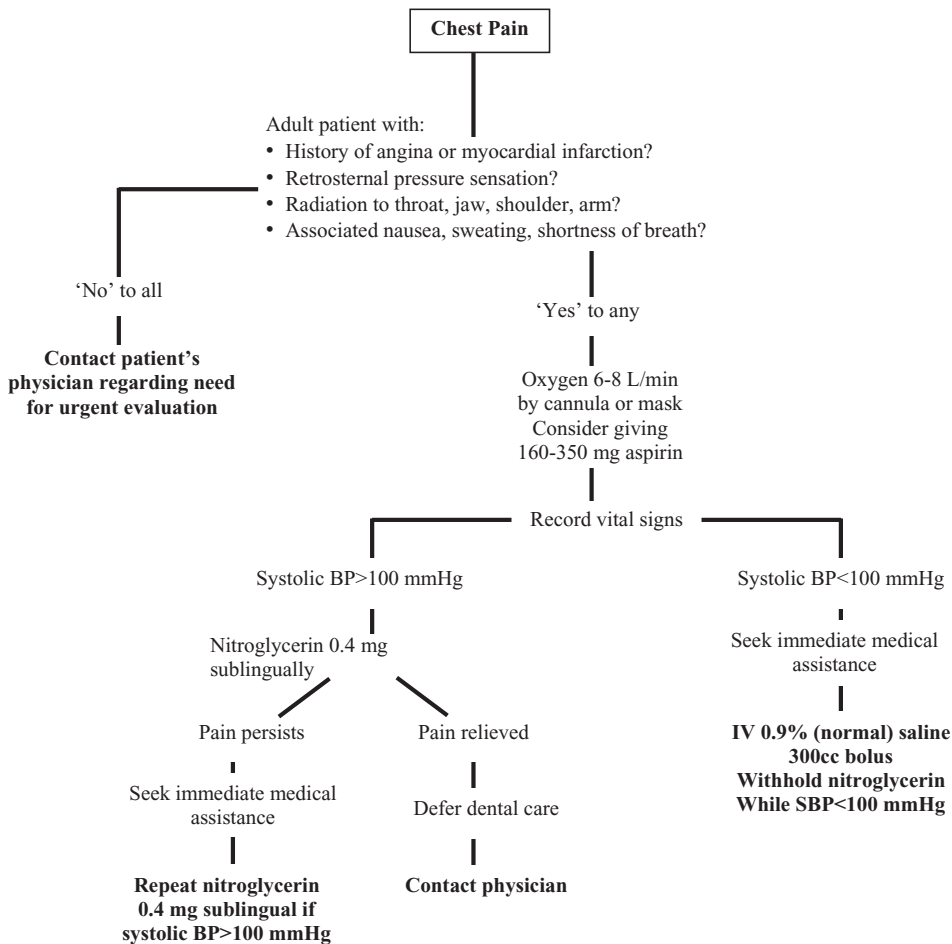


Figure 6.8. Evaluation of chest pain.

At the onset of any worrisome symptoms, all dental procedures should be terminated and the patient placed in a position that makes him or her feel comfortable. The dental practitioner should begin simple monitoring, assessment, and support for the patient with a sphygmomanometer, pulse oximeter, and/or electrocardiograph if available. Most patients with angina or MI are responsive and able to communicate although they may describe a sense of impending doom and panic. Patients with a history of stable angina can be very knowledgeable about their own symptoms and management and should be encouraged to treat their symptoms as they would at home with sublingual nitroglycerin if they believe this is their typical angina.

Emergency medical services should be summoned if in an office setting, or a “code” called if in a hospital outpatient or inpatient setting for patients with new or atypical symptoms, or those who show any sign of distress. Pulse, respirations, blood pressure, and oxygen saturation are helpful information for the cardiologist and resuscitative team. The airway should be supported, along with breathing and circulation. Oxygen should be provided via nasal cannula. Aspirin, 160 to 325 mg, should be administered orally for the patient to chew and swallow. Nitroglycerin, 0.3 to 0.4 mg, may be provided sublingually or via nasal spray, although this may cause severe hypotension in some MI cases and is best administered in the presence of emergency medical services. If the provision of intravenous medication is within the practitioner’s scope of practice, an intravenous line may be initiated and morphine administered. The practitioner should be prepared to begin basic (or advanced) cardiac life support at any time.

For patients with suspected ACS who become unresponsive, the principals and practices taught in basic or advanced cardiac life support should be initiated. All dental procedures should be discontinued. Emergency medical services should be summoned if in an office setting, or a “code” called if in a hospital outpatient or inpatient setting. Again, the material contained within this chapter is not intended to supplant such courses, but to put management of these problems into perspective when they occur in the dental setting. As such, these are considered “witnessed arrests” and more than one provider will be presumed to be present.

The patient should be placed on a back board or on the floor and pulse checked. If no pulse is present, chest compressions should begin with 30 compressions and two breaths for adults, or 15 compressions and two breaths for children (two rescuers are presumed to be present). After the initial compressions, the airway should be opened and breaths provided. If the patient is breathing, her or she may be placed on his or her side in a recovery position. If not, cardiopulmonary resuscitation (CPR) should resume with compressions (C) at a rate of at least 100 per minute, airway (A) maintained, and breathing (B) continued at a rate of eight to 10 breaths per minute. The rescuers should rotate every two minutes. If an automated electronic defibrillator (AED) arrives, the CPR should be continued until the AED is in position to be used, rhythm checked, and shock delivered if appropriate. CPR should be resumed and a rhythm checked every two minutes.

For practitioners who have taken Advanced cardiac life support education, whose education, training, and scope of practice permit, and whose facility is appropriately equipped, the next level of care may be provided. This includes but is not limited to the provision of intravenous (or intra-osseous) fluids, intravenous (or intra-osseous) medications, and endotracheal intubation or surgical airway access. Reversible

causes for the cardiac event should be explored, including hypovolemia, hypoxia, hydrogen ion (acidosis), hypo/hyperkalemia, hypothermia, tension pneumothorax, cardiac tamponade, pulmonary thrombosis, coronary thrombosis, and medication toxicity. The patient should be routinely reassessed and administered CPR as necessary throughout. In all cases, administration of intravenous medications, endotracheal intubation, cardioversion, and the use of complex anti-arrhythmic medications are best managed in an intensive cardiac care setting, and not in a dental office or hospital dental outpatient facility. Assessment, stabilization, and transport to such a facility are appropriate responsibilities for the dental practitioner.

Angina Pectoris

Signs and Symptoms The signs and symptoms of angina pectoris are effort-related substernal pressure, or sensation of heaviness or weight that can radiate to the throat, jaw, right or left shoulder, and/ or arm. Episodes last less than 15 minute and can be accompanied by shortness of breath, nausea, and sweating. A consistent pattern is easily identified by the patient. Angina pectoris usually responds to sublingual nitroglycerin (Figure 6.8).

Prophylaxis

- History of angina, triggers, management, and frequency of episodes should be obtained.
- Take time to reassure the patient and explain treatment.
- Pain control should be obtained.
- The patient should bring nitroglycerin medication to the dental office, and it should be placed where it will be readily accessible to the staff.
- Pretreatment: One tablet nitroglycerin sublingual.
- Stressful procedures: Patient should be scheduled early in the day and oral tranquilizers or other sedation (e.g., nitrous oxide) should be considered.

Specific Treatment

- Nitroglycerin 0.4 mg sublingual. Tablets should be stored in brown glass bottle. Alternatively, a spray may be used. Check expiration date to assure potency.
- Oxygen 6–8 L/min by nasal cannula or mask.
- Record vital signs.
- If first dose is ineffective and systolic pressure is above 100 mmHg, nitroglycerin dose should be repeated every five minutes for a total of three doses.
- If the angina is new, or it differs from the usual pattern in a patient with chronic angina, the patient should be transported to an emergency facility.
- If chest pain persists after three doses of sublingual nitroglycerin, give one aspirin tablet, initiate 0.9% saline IV at 100 cc per hour, and call emergency medical services.

Myocardial Infarction

Signs and Symptoms The signs and symptoms of myocardial infarction are retrosternal, squeezing pressure or pain that can radiate to the throat, jaw, the right or left

shoulder and/or arm. Atypical symptoms include nausea, reflux, and indigestion. There may be a history of angina. Symptoms may be stuttering or unremitting, unresponsive to nitroglycerin, and usually last longer than typical angina symptoms. There is often a sense of weakness, impending doom, and anxiety. Associated signs and symptoms may include sweating, nausea, vomiting, pallor, and cyanosis.

Specific Treatment

- Stop all dental procedures immediately.
- Call EMS immediately.
- Administer oxygen 6–8 L/minute by nasal cannula or mask.
- Monitor blood pressure; if the systolic pressure is above 100 mmHg, nitroglycerin can be administered sublingually every five minutes for three doses or sooner if pain is relieved.
- A dose of 160 to 350 mg aspirin should be chewed by the non-aspirin-allergic patient.
- 0.9% (normal) saline IV should be started at keep open rate.
- The patient should be maintained in the most comfortable position, even if not supine.
- Arrange transportation to the nearest emergency department, via ambulance with paramedics if possible.
- Give morphine, 3 to 4 mg, IV every five to 10 minutes as needed for pain (under physician supervision) if no response to nitroglycerin.

Cardiac Arrest

Signs and Symptoms In cardiac arrest the patient is cyanotic, unresponsive, pulseless, and apneic.

Treatment

- Seek immediate emergency medical assistance.
- Check breathing first. If absent, check for airway obstruction, then give two slow breaths. Then check carotid pulse.
- If both absent, full CPR should be administered in conjunction with use of an automated external defibrillator, if available (Figure 6-9).
- When medical assistance arrives, advanced cardiac life support (ACLS) procedures should be initiated and the patient transferred to an emergency department.
- Intravenous lines should be started only after CPR is being adequately administered.

Hypotension

Management of hypotension is a decision made by the practitioner based upon the scope of practice and specific training of the individual. Those who provide intravenous sedation and/or general anesthesia must be well versed in the management of perioperative hypotension. Hypotension in the perioperative period is defined as a reduction in blood pressure of 15% to 20%; it can have a number of causes (Table 6.1, Figure 6.10). Contributing factors such as the preoperative hydration and

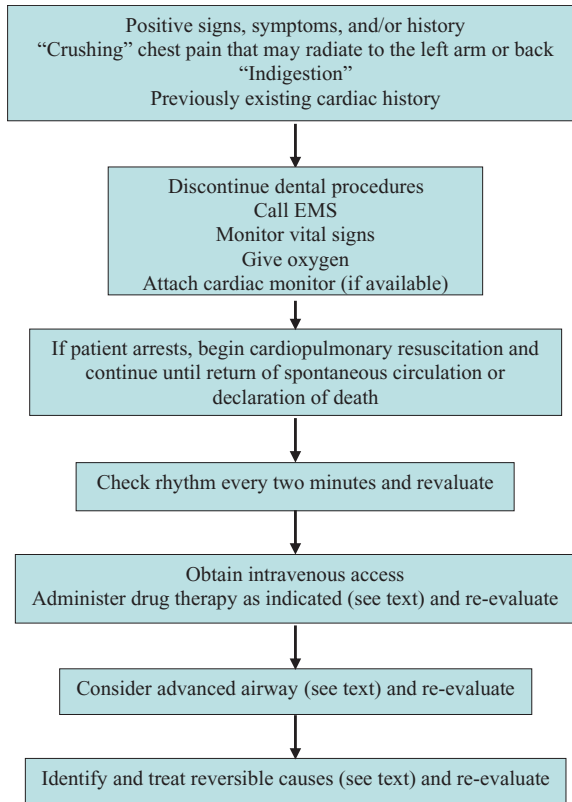


Figure 6.9. Suspected cardiac event.

Table 6.1. Causes and Treatment of Hypotension

Cause	Treatment
Hypovolemia	Trendelenburg position; fluids. Exclude hemorrhage.
Drugs (narcotic analgesics, anesthetics)	Increase IV fluids (if no cardiac dysfunction)
Decreased cardiac output	Exclude hypovolemia (actual or relative) before using pressors. If a cardiac cause is suspected, obtain immediate medical consultation.

general condition of the patient, systemic infection, current medical illnesses (especially congestive heart failure), and current medication including antihypertensives should be considered. Intraoperative causes, especially with intravenous sedation and/or general anesthesia, such as a medication overdose, may result in hypoxemia and/or hypercarbia with resultant hypotension. While rare, a local anesthetic overdose and shock, or allergic reactions such as anaphylaxis (see the section on anaphylaxis to follow), are also potential causes of hypotension.

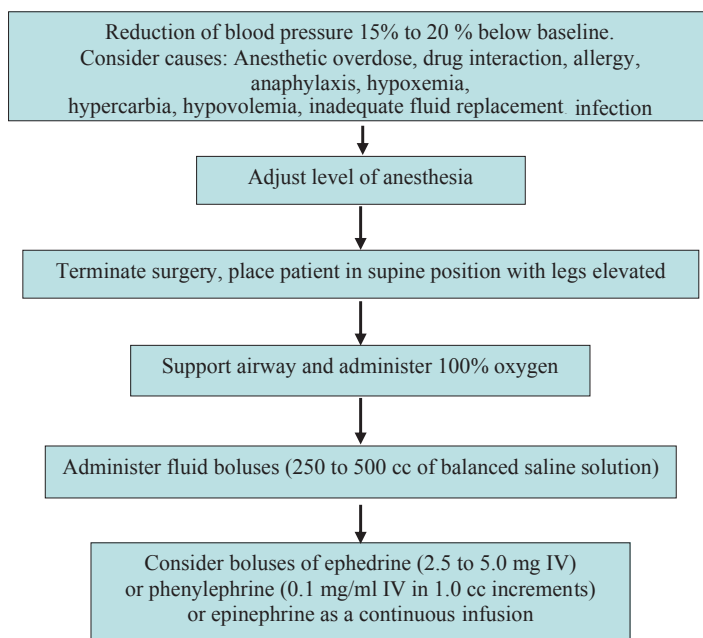


Figure 6.10. Hypotension.

For the anesthetized or sedated patient who becomes hypotensive, the level of sedation/anesthesia should be adjusted. A Trendelenburg position with head down and feet elevated assures the best possibility for maintenance of intracranial circulation and oxygenation. The airway should be supported and supplemental oxygen administered. Fluid challenges with 250 to 500cc of a balanced intravenous saline solution can be administered. Pressors consisting of ephedrine, phenylephrine, or epinephrine may be chosen to elevate the blood pressure if the administration of intravenous medication is within the practitioner's scope of practice.

Hypertension

As with hypotension, management of hypertension is a decision made by the practitioner based upon the scope of practice and specific training of the individual. Those who provide intravenous sedation and/or general anesthesia must be well versed in the management of perioperative hypertension. A blood pressure of 160/90 in the perioperative period, or what would be considered elevated for the specific patient, should be managed (Figure 6.11). Pre-operative causes such as preexisting hypertension, apprehension, or use of medications or substances that raise blood pressure should be identified and addressed before the procedure when possible. Intraoperative causes include light sedation or general anesthesia, inadequate local anesthesia, the use of vasoconstrictors in the local anesthesia, fluid overload, hyperthermia, hypoxia, hypercarbia, and anxiety. The management is based upon the individual circumstances and the patient's cardiovascular status. Inadequate or ineffective anesthesia or sedation should be corrected. For patients with tachycardia

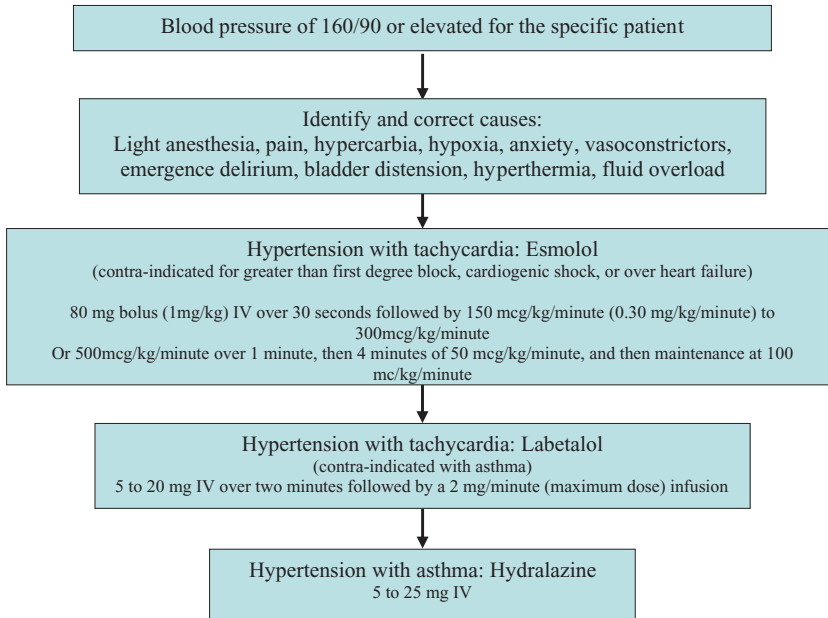


Figure 6.11. Hypertension.

Table 6.2. Causes and Treatment of Hypertension

Cause	Treatment
Pain	Increase analgesics
Hypervolemia	Fluid restriction; consider diuretic
Urinary retention	Catheterization
Pre-existing hypertension	Consider a temporary increase in patient's medication or small doses of IV antihypertensive drugs

and hypertension, esmolol is effective for patients who do not suffer from second or third degree heart blocks, cardiogenic shock, or congestive heart failure. Labetalol is an excellent choice, but is contraindicated for asthmatics, for which hydralazine may be effective (Table 6.2).

Cerebral Vascular Accident (Stroke)

The subject of a cerebrovascular accident (CVA) and its complete management is beyond the scope of this publication. The reader is directed to the American Heart Association's courses in Emergency Cardiovascular Care for Healthcare providers

for a full review of the definitive management. Recognition of the signs and symptoms by the practitioner, transport to the appropriate facility, and timing of therapy are important for the overall survival of the patient.

CVA (stroke) is the result of compromised intracerebral blood flow resulting in ischemia in a particular part of the brain. It can be caused by thromboembolic occlusion of an artery (ischemic stroke), or intracerebral bleeding leading to edema and tissue damage (hemorrhagic stroke). Both types of CVA require immediate medical attention and management, although therapy differs. Thromboembolic stroke therapy is geared toward thrombolysis or anticoagulation, whereas hemorrhagic stroke management focuses on controlling the intracranial bleeding.

CVA is a medical emergency that may result in extensive neurological damage or death. The first and most critical element of stroke care is recognition of the signs and symptoms which can include slurred speech, facial droop, weakness of the limbs, or even weakness or paralysis one entire side of the body (Figure 6.12). The Cincinnati Pre-Hospital Stroke Scale or Los Angeles Pre-Hospital Stroke Screen are useful tools in assessing and categorizing the signs and symptoms of a stroke (Appendix 5). The patient's airway should be supported and supplemental oxygen provided while circulation is maintained. A history of events and time frame is an important aspect of the management of this problem. It is ideal to have the patient transported to a stroke facility immediately after recognition, because definitive management is best provided within three hours of the onset of symptoms. The patient should be assessed within 10 minutes of arrival at the emergency facility, have a neurologic specialty exam within 25 minutes, computed tomography within 45 minutes, and a decision to provide anticoagulant or antiplatelet therapy within an hour.

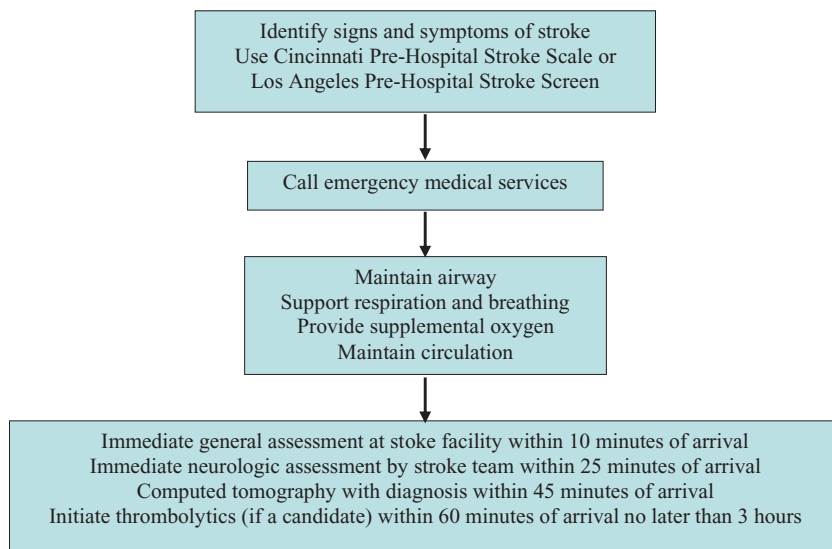


Figure 6.12. Cerebrovascular accident.

Postural Hypotension

Postural hypotension is seen in patients with dehydration, diabetes, or cardiovascular disease, or as a result of drug therapy. It is frequently seen following dental care that has been delivered in a supine position but is also common after sitting (even upright) for an extended period (Figure 6.10). Onset occurs just after assuming an upright position.

Drug Reaction

- Oversedation: Benzodiazepines, nitrous oxide, or opioids
- Hypotension: Antihypertensive drugs (alpha-blockers, beta-blockers, nitrates)

Epilepsy: Seizures

Seizures in the dental setting most frequently follow a syncopal episode. Alcohol withdrawal, fever, hypoglycemia, hyponatremia, and subtherapeutic anticonvulsant levels in known epileptics or head injury patients are also causes. These patients frequently have an aura prior to the seizure. It may be a feeling of an impending seizure or increased anxiety or depression minutes prior (Figure 6.13). For petit mal seizures, the patient may appear to have fallen asleep. Assessment of the level of consciousness and verification of other causes, such as hypoglycemia, should be undertaken. Grand mal seizures with tonic-clonic movements are much more dramatic and potentially upsetting to the practitioner and staff, as well as the patient. The patient may fall to the floor if standing, cry out as air is rapidly exhaled, and the eyes will appear to roll back. The tonic-clonic contractions of the extremities may last for three to seven minutes. Dilation of the pupils, apnea, and cyanosis, as well as urinary and fecal incontinence, are common seizure features until the patient's physiology and activity return to normal.

The clinician's first responsibility is to protect the patient and staff from jaw clenching and the flailed limbs resulting from the tonic-clonic motions. Restrictions

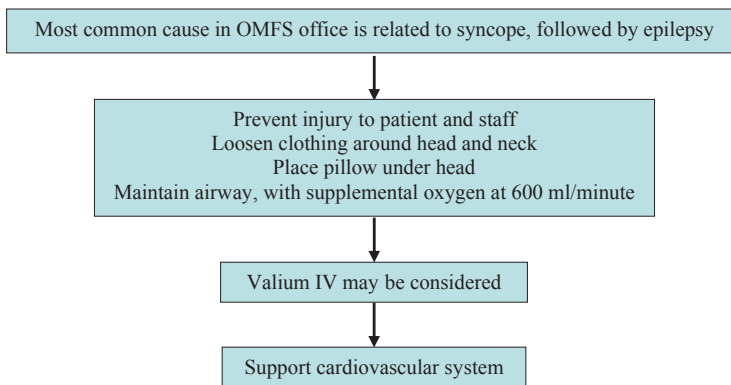


Figure 6.13. Seizures.

such as tight clothing or other objects should be eliminated. A pillow under the head and/or other padding is helpful. Because seizures result in enhanced brain activity, greater intracranial oxygen consumption occurs. Thus, supplemental oxygen should be administered. Most seizures are of a short duration. If the provision of intravenous medication is within the practitioner's scope of practice, diazepam may be considered for prolonged seizures. Intravenous access is difficult in the actively seizing patient.

Definitions

Generalized Tonic–Clonic Seizures (Grand Mal)

Of all the types of seizures, this is the most alarming type of seizure and the one that may require treatment. It is caused by transient alterations in brain function characterized by the abrupt onset of tonic–clonic movements.

Status Epilepticus

There is lack of consensus on the seizure duration that defines status epilepticus. Traditionally, generalized convulsive status epilepticus was defined as 30 minutes of continuous seizure activity or a series of seizures without return to full consciousness between the seizures. However, many have suggested times as brief as five minutes to define status epilepticus because there is evidence demonstrating that a shorter period of seizure activity can cause neuronal injury and that seizure self-termination is unlikely after five minutes. In this text, a duration of five minutes of continuous generalized convulsive activity is used arbitrarily as part of the definition of status epilepticus, as well as recurrent seizures without a return to consciousness between seizures. Cerebral damage, cardiac or renal failure, and death can result. This is a medical emergency.

Causes/Triggers

- Alcohol withdrawal
- Fever (children aged between three months and five years)
- Hypoglycemia
- Hyponatremia
- Subtherapeutic anticonvulsant levels
- Local anesthetic toxicity
- Others: Stress, pain

Signs and Symptoms

- Increased anxiety or depression minutes to hours prior
- Aura: Feeling of impending seizure activity a few seconds prior to seizure onset (an unusual phenomenon)

- Convulsive or ictal phase consisting of patient falling to floor, “epileptic cry” as air is expressed, eye deviation, clonic–tonic contractions (high amplitude/frequency movements of all extremities for three to seven minutes). Autonomic system discharge with dilated pupils, apnea, and cyanosis, ending with respirations returning to normal; urinary and fecal incontinence
- Postictal phase: Patient disoriented and confused with gradual return to fully oriented state over a period of minutes to hours

Treatment

Patient Position

- Supine on covered floor, if possible
- Careful observation of eye and extremity movements helpful for subsequent diagnostic evaluation

Prevention of Self-Injury

- Removal of hard objects from area
- Gentle restraint of extremities from gross movement
- Soft head rest
- Ensure adequate ventilation (e.g., oxygen 100%, maintenance of a patent airway and mouth suction) and supportive care in the postictal stage

Treatment for Status Epilepticus and Seizures over Five Minutes in Duration

- Position patient supine on floor, if possible
- Airway maintenance
- Mouth suction
- Monitoring of vital signs
- Medical assistance should be sought
- Diazepam may be administered (may repeat dose every 15 minutes as needed to maximal dose)
 - Child under five years of age: 0.1 to 0.3 mg/kg slow IV (1 mg/minute over three minutes) or deep IM, with initial dose not exceeding 0.25 mg/kg to a maximum of 0.75 mg/kg total dose for episode; maximal total dose 5 mg; for child over 5 years: 1 mg/dose, maximal total dose: 10 mg
 - Adult: IV bolus 5 to 20 mg at 2 mg/minute
- If possible, obtain intravenous access

Diabetic Emergencies

Insulin (Hypoglycemic) Shock

Insulin shock is a highly unusual and highly unlikely scenario in the dental setting, yet, because miscommunication and mishaps can occur, its management is discussed

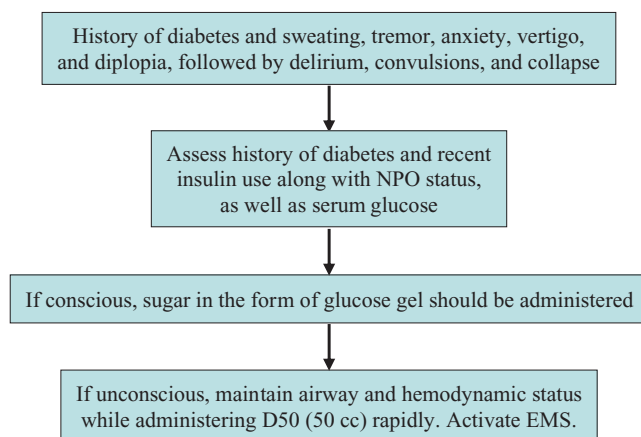


Figure 6.14. Insulin shock.

here. Patients with diabetes mellitus type I are frequently managed with insulin, a hormone that helps the body's cells and tissues absorb glucose after dietary intake. When too much insulin is administered, or too little glucose is consumed, severe diabetic hypoglycemia can result in insulin shock and ultimately a diabetic coma. In the dental setting, this is most likely to occur with miscommunication regarding preoperative instruction for intravenous sedation or general anesthesia. A patient who takes his or her routine dose of insulin, yet has not taken any sustenance by mouth, in keeping with an "NPO" scenario prior to intravenous sedation or general anesthesia, is at risk.

Onset of dangerous hypoglycemia can be sudden and rapid. Patients may appear anxious, tremulous, sweating, dizzy, and/or with diplopia (Figure 6.14). This may be followed by delirium, convulsions, and cardiovascular collapse. The history of the events must be verified and if conscious, sugar in the form of glucose should be administered. If unconscious, the airway and hemodynamic status should be maintained as described in previous sections. Emergency medical services should be summoned if in an office setting, or a "code" called if in a hospital outpatient or inpatient setting. If the provision of intravenous medication is within the practitioner's scope of practice, D50 should be administered rapidly.

Insulin Shock

History

The history includes insufficient carbohydrate intake relative to normal or excessive insulin intake and excessive exercise.

Onset

The onset is sudden (minutes).

Signs and Symptoms

- Disoriented behavior, mental confusion
- Tremors
- Pale, moist skin
- Sweating
- Bounding pulse
- Convulsions and/or loss of consciousness (Figure 6.2).

Treatment

Conscious Patient Give foods containing simple sugars (e.g., soda, candy, orange juice, sugar water).

Unconscious Patient The following guidelines are recommended:

- Obtain intravenous access
- Bolus of one ampule of 50% dextrose IV push should be administered
- If IV access cannot be gained, 0.5 (adult and children under 25 kg) to 1 mg (adult and children over 25 kg) glucagon IM
- Monitoring of vital signs
- Medical assistance should be summoned

Diabetic (Hyperglycemic) Coma

History

The history of diabetic coma includes normal to excessive food intake with insufficient insulin. There may be a history of infection, infarction, dietary indiscretions, or noncompliance with hypoglycemic medications.

Onset

The onset is gradual (usually days).

Signs and Symptoms

- Frequent urination
- Intense thirst
- Dry skin and mucous membranes
- Vomiting, often with abdominal pain
- Acetone odor to breath
- Low blood pressure with weak, rapid pulse
- Lethargy, weakness

Treatment

- Medical assistance should be summoned
- IV 0.9% (normal) saline 200cc/hour

- When in doubt, it is safer to treat for assumed hypoglycemic shock than diabetic hyperglycemic coma
- Usual dose of insulin may be administered if hypoglycemia is absolutely ruled out
- Basic life support if unconscious

Allergic Reactions

Immediate Hypersensitivity

Signs and Symptoms

The allergic reaction begins within minutes of the antigen exposure (Figure 6.15). Mast cells release several peptides, including histamine, leukotriene, and prostaglandin D₂ (PGD₂). Smooth muscle contraction and vasodilation lead to any combination of laryngeal edema, bronchospasm stridor, wheezing, itching, urticaria, anxiety, hypotension, and cardiopulmonary arrest.

Most reactions to local anesthetics are not true allergic reactions to the anesthetic itself but are due to inadvertent intravascular injection of solutions containing epinephrine, toxic levels, or reactions to preservatives in the local anesthetic solution. A careful history may help prevent occurrence of allergic reactions.

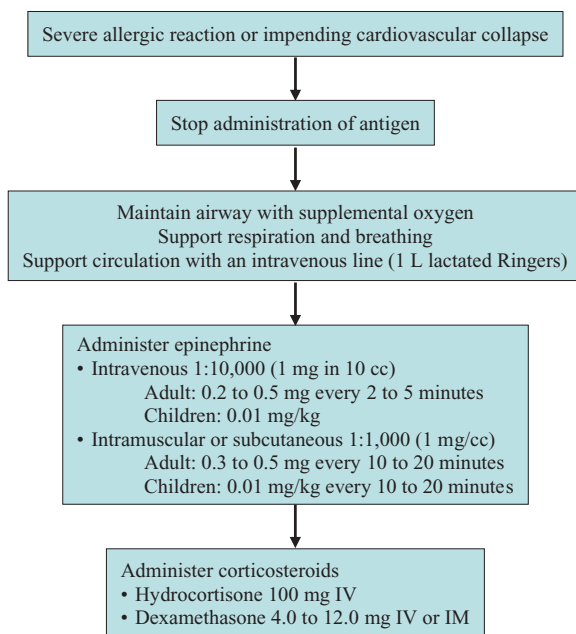


Figure 6.15. Anaphylaxis.

Treatment

Systemic Reaction (Bronchospasm Stridor, Wheezing, Tachycardia, Hypotension)

- The patient should be placed in a supine position with legs elevated.
- Medical assistance should be sought.
- Airway should be maintained. Change in quality of voice or presence of stridor suggests presence of airway edema.
- Oxygen 6L/minute by nasal cannula or face mask should be administered.
- Blood pressure should be recorded.
- An IV should be started, 0.9% (normal) saline or Ringer's lactate if available, flow rate as needed to maintain systolic blood pressure above 90 mmHg.
- Administer medications:
 - Epinephrine 1:1,000 dilution, 0.3 cc subcutaneously to adults or 0.01 cc/kg subcutaneously to children. Repeat every five to 10 minutes as needed. Do not administer epinephrine intravenously except in cases of complete cardiopulmonary arrest
 - Hydrocortisone 200 mg IV to adults or 2.5 mg/kg IV to children
 - Diphenhydramine (Benadryl®) (Appendix 12, Table A12-6)
- Be prepared to intubate or perform cricothyrotomy if unable to intubate due to airway edema.
- Be prepared to deliver CPR.
- Should be distinguished from vasovagal syncope, which typically produces bradycardia, hypotension, and pallor (as opposed to the tachycardia, hypotension, and erythema seen in anaphylaxis).

Cutaneous Reaction

- Patient has urticaria or itching but no stridor or wheezing.
- Vital signs are normal.
- Watch for systemic involvement.
- Give diphenhydramine every six hours as needed for adults (six to eight hours for children) (Appendix 12, Table A12-6).

Delayed Hypersensitivity (Cellular Hypersensitivity)

Signs and Symptoms

The reaction begins hours after antigen exposure, peaking in approximately 24 to 48 hours.

- Induration and swelling (e.g., positive tuberculin test)
- Contact dermatitis
- Graft rejection

Treatment

For a mild systemic reaction, administer diphenhydramine (Appendix 12, Table A12-6). Identify and avoid the offending allergen.

Miscellaneous

Foreign Bodies or Instruments Swallowed or Aspirated

While a rare occurrence, an object or instrument lost somewhere in the mouth during a dental procedure does occur. This becomes most significant if the object is lost within the airways, bronchi, or lungs, and moderately so if it is a sharp instrument that has been swallowed. When there is a suspicion that an instrument such as an endodontic file, rubber dam clamp, tooth, or crown is lost in the mouth, the surgical field should be immediately examined to verify that the instrument is no longer on the field (Figure 6.16). Next the mouth and oropharynx should be examined.

Occasionally the patient will be able to tell whether the object was inhaled (aspirated) or swallowed. If not, the first caution is for a patent airway. If signs or symptoms of an airway obstruction exist, the patient should be stabilized and managed as in Figure 6.4. If the aspirated object induces a bronchospasm, then the patient should be managed as in Figure 6.5. An airway obstruction or bronchospasm with cyanosis and deterioration are life-threatening emergencies and require immediate management. If an object is aspirated and the patient is stable, time can be taken for the appropriate imaging, cardiothoracic consultation, and eventual bronchoscopy to remove the object from the bronchi or lungs.

For blunt objects that have been swallowed such as a crown or tooth fragment, outpatient observation of the patient and monitoring of the stools for object passage and verification is effective. A high-bulk diet and stool softeners will make passage more comfortable and rapid. For a sharp instrument, such as an endodontic file or jaw fixation wire, imaging and early location verification are paramount. It is ideal

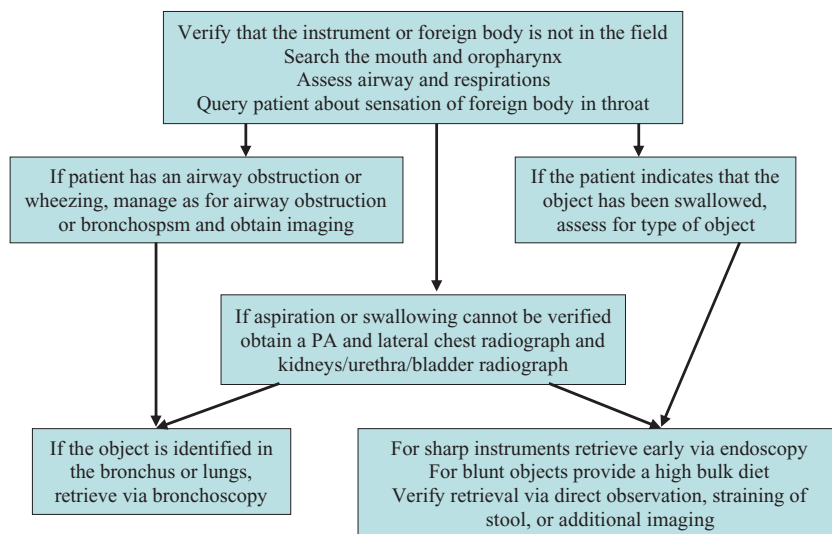


Figure 6.16. Foreign body or instrument swallowed or aspirated.

to provide the endoscopist with the earliest opportunity to remove the object from the esophagus or stomach, prior to passage into the intestines.

For both swallowed and aspirated objects that cannot be retrieved endoscopically, or passed naturally, an open surgical approach and direct retrieval are necessary.

Emesis and Aspiration

The aspiration of emesis is most likely be encountered in patients who are obtunded by sedation or general anesthesia. It must be remembered that even nitrous oxide at a particular concentration for some patients can provide a general anesthetic response. The neurologically compromised patient also may suffer this problem. Aspiration of gastric contents provides numerous levels of concern. First, large particles of food can cause a physical obstruction and block the passage of oxygen to the bronchi or alveoli. The magnitude of the volume of the aspirated fluid also can impede oxygen perfusion. The acidic pH of the gastric contents can burn the alveolar mucosa. The response of the alveoli to stimulation by foreign material can cause a reactive bronchospasm. Finally, microbes that may be found within the gastric contents could cause pneumonia.

When vomiting is witnessed, the patient should be immediately positioned head down if sedated or generally anesthetized, or on the side if awake (Figure 6.17). High-volume suction with a wide aperture should be used to evacuate the vomit. The patency of the airway should be assessed and signs and symptoms of aspiration noted. These include rales, dyspnea, tachycardia, bronchospasm with wheezing, and cyanosis. Oxygen should be administered. If there is severe dyspnea or cyanosis, and/or signs of shock, such as tachycardia and hypotension, then immediate emergency management is necessary. EMS should be summoned if in an office setting, or a “code” called if in a hospital outpatient or inpatient setting. Intubation, lavage,

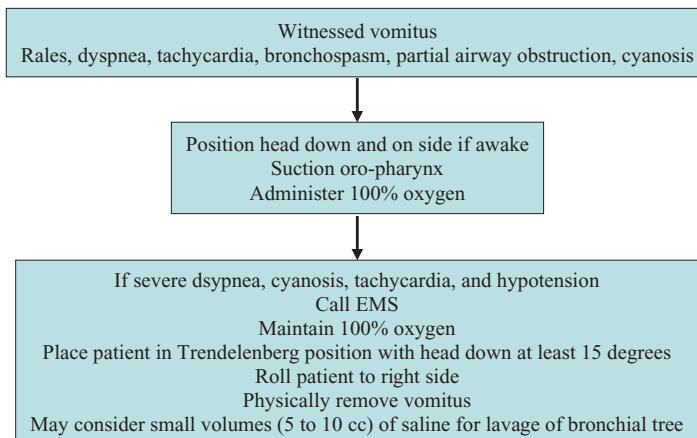


Figure 6.17. Emesis and aspiration.

steroids, and antibiotics may all be considered depending upon the individual circumstances of the aspiration and the specific practitioner's training and scope of practice.

Bleeding

Hemostasis can be altered by extrinsic factors (e.g., medications) or intrinsic abnormalities (e.g., liver disease, hemophilia or thrombocytopenia).

Patient Evaluation

History

- Previous bleeding experience (frequency, severity, duration, apparent cause)

Examination

Look for jaundice, ecchymoses, petechiae, or hemarthrosis.

Laboratory Tests

Consider deferral of elective surgical procedures or the need for preprocedure medical management in patients with the following:

- Platelet count under 50,000
- Partial thromboplastin time (APTT) greater than two times normal
- Prothrombin time greater than two times normal or international normalized ratio (INR) greater than 3.5

Treatment of Hemorrhage

Local Management Techniques

- Apply pressure to area with gauze for at least five minutes
- Infiltrate with 2% lidocaine with epinephrine (1:50,000 or 1:100,000).
- Ligate vessel or tissue with suture if brisk bleeding.
- Use absorbable cellulose and/or suture to close socket.
- Apply ice pack to area extraorally (five minutes on and five minutes off).
- Crush surrounding bone or pack with bone wax for alveolar bone hemorrhage.
- If bleeding persists, pressure should be applied with gauze soaked in topical thrombin. Anecdotal evidence suggests that epsilon aminocaproic acid (EACA 25%, Amicar® syrup mouthwash) may help in some situations where thrombin fails.
 - Off-label use: Some reports have suggest that 5% tranexamic acid and/or Amicar® syrup, 250 mg/ml, may be used as an oral rinse (rinse two minutes QID for seven days). No food or drink to be consumed within one hour of using mouthwash).

- Microfibrillar collagen hemostat may be sprinkled on area and after several minutes gently flushed with water or used to plug extraction sockets.
- Electrocautery.

Systemic Management Techniques

- For patients with coagulopathy that is primary or secondary to severe hepatic cirrhosis, the physician might need to be consulted to arrange for transfusion with packed red cells (typed and cross-matched) or transfusion of appropriate coagulation factors.
- In the rare event that the INR test level is too high, the patient's physician may want to use vitamin K to reverse the warfarin effect, within six to 10 hours. Fresh frozen plasma (200 to 500cc) will reverse warfarin effects immediately. Protamine sulfate, 25 to 50mg IV over 30 minutes, will reverse heparin immediately when the heparinization needs to be reversed. Simply turning off heparin will normalize coagulation over three to four hours.
- Platelet transfusion of one unit per 10kg body weight of random multidor donor platelets or one donor apheresis unit may be used in patients with abnormal bleeding and platelet count below 50000.
- Desmopressin acetate (DDAVP), 0.3 microgram/kg (for both adult and child) IV or SC, can help clotting in von Willebrand's disease, mild-moderate hemophilia A, and bleeding due to uremic platelet dysfunction.
- Obtain vital signs and hematocrit if significant blood loss occurs. Physician involvement is important for patients with uncontrolled bleeding, abnormal vital signs, or symptomatic acute blood loss, or for suspected abnormalities of APPT, INR, platelet count, bleeding time, or hematocrit.

Shock

Definition

Shock is an inadequate blood flow to vital organs or a failure of vital organ cells to utilize oxygen.

Types (Figure 6.18)

- Hypovolemic (Causes: diarrhea, hemorrhage [internal and external], vomiting, inadequate fluid intake, osmotic diuresis [e.g., diabetic ketoacidosis], third space losses, burns)
- Cardiogenic
- Septic
- Anaphylactic
- Obstructive
- Neurogenic

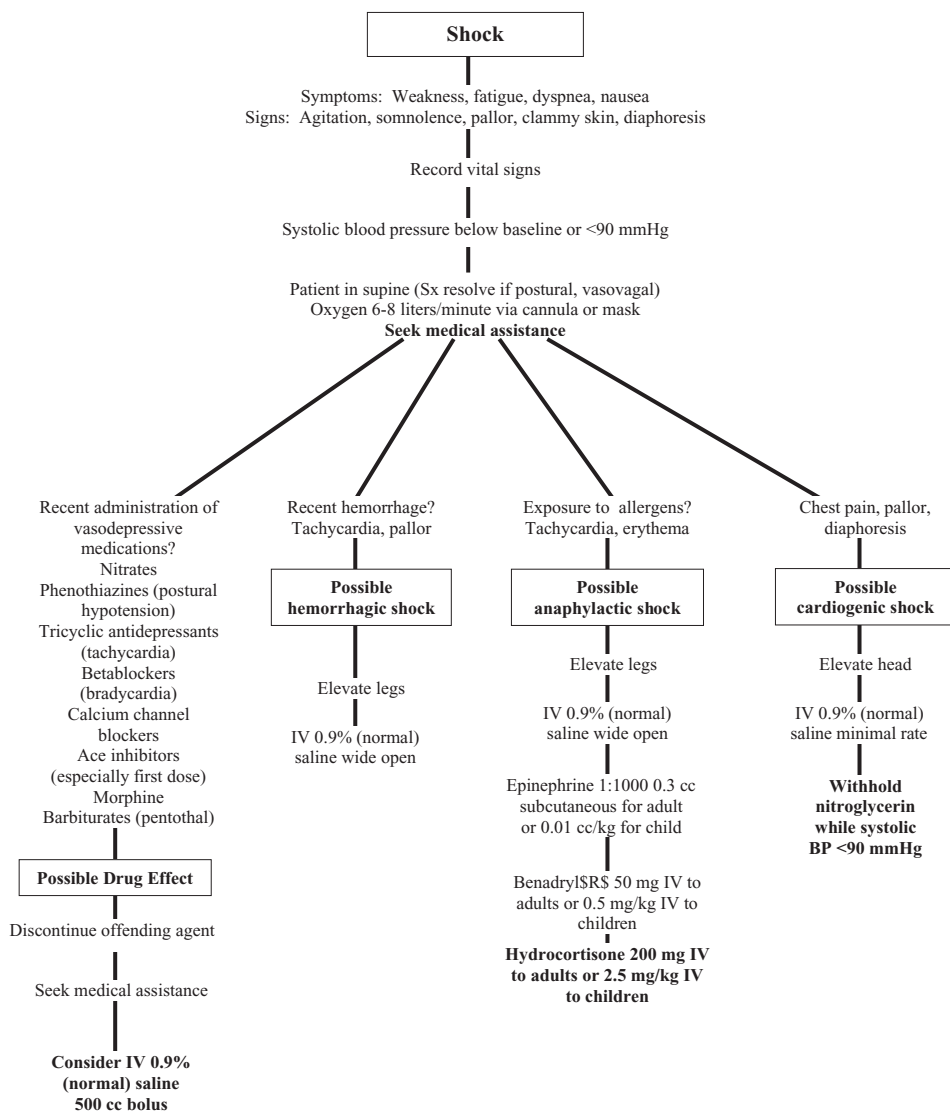


Figure 6.18. Shock.

Signs and Symptoms

- Altered mental status
- Cold, clammy extremities
- Delayed capillary refill (greater than two seconds at nail bed)
- Tachycardia and tachypnea
- Weakened central pulses and absent peripheral pulses
- Hypotension (usually late finding)

Treatment

- Check for adequate pulse and respirations.
- Medical assistance should be sought.
- Patients with hemorrhagic, septic, or anaphylactic shock should be placed in the Trendelenburg position (supine with feet elevated and head low). Patients with cardiogenic shock should be supine with the head elevated.
- Provide oxygen by mask at a flow of 6 to 8 L/minute.
- Fluid resuscitation: An IV drip should be started with 0.9% saline wide open for hemorrhagic, septic, or anaphylactic shock, but at sufficient rate to keep open for cardiogenic shock.
 - For children: Isotonic crystalloid 20 ml/kg bolus over five to 20 minutes. Repeat in 20 ml/kg boluses to restore blood pressure and tissue perfusion.
- Blood pressure should be obtained. If blood pressure is below 90 mmHg systolic, consider specific therapy:
 - Allergic reaction
 - Severe hemorrhage

Drug Overdose and Toxicity

Asymptomatic Patient

Lack of symptoms of overdose or toxicity does not guarantee a harmless ingestion (Figure 6-19).

Treatment

- Consult product label or local poison control center for initial management of specific overdose.
- Patient should be transported to the emergency department.

Symptomatic Patient

- Medical assistance should be sought.
- Check for pulse and respirations; administer CPR as needed.
- Respiratory support: If pulse is adequate but breathing is labored or depressed:
 - Airway should be cleared: Look for oral foreign body, perform jaw thrust
 - Provide oxygen 6 L/minute by nasal cannula or face mask
 - Provide ventilation with mouth-to-mouth or bag valve mask if patient becomes pale or cyanotic. Insert nasopharyngeal airway and suction of excess secretions
 - Intubate using cuffed endotracheal tube if above measures are unsuccessful
- IV 0.9% (normal) saline may be started at 50 cc/hour for an adult. For systolic blood pressure below 80 mmHg, normal saline should be administered at a rate of 200 cc/hour for an adult.
- Patient should be transferred for medical care, via ambulance if possible.

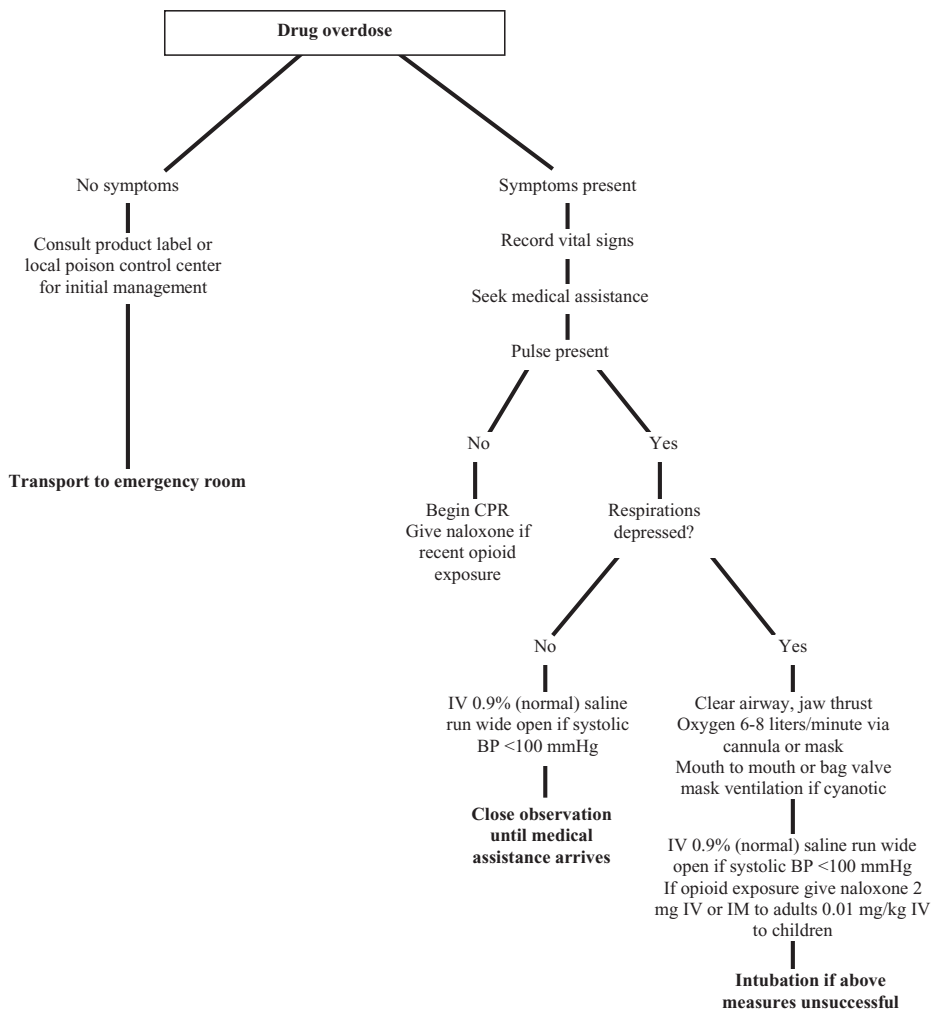


Figure 6.19. Evaluation of drug overdose.

Opioid Overdose

- Check for respirations and pulse. If both are absent, full CPR should be administered.
- When medical assistance arrives, advanced cardiac life support (ACLS) procedures should be initiated and the patient transferred to the emergency department.
- Intravenous lines should be started only after CPR is being adequately administered.
- Naloxone (NarcanTM): 2 mg IV, IM, or SC for adults or 0.01 mg/kg IV, IM, or SC for children.

Benzodiazepine Overdose

- Respiratory support: If pulse is adequate but breathing is labored or depressed:
 - Airway should be cleared. Look for oral foreign body, perform jaw thrust
 - Administer oxygen 6 L/minute by nasal cannula or face mask
 - Provide ventilation with mouth-to-mouth or bag valve mask if patient becomes pale or cyanotic. Insert nasopharyngeal airway and suction excess secretions
 - Intubate using cuffed endotracheal tube if above measures are unsuccessful
- Monitor vital signs.
- Flumazenil: 0.2 mg (2 cc) IV over 15 seconds; repeat if desired level of consciousness is not obtained within 60 seconds (maximum total dose: Child: 1 mg; Adult: cumulative dose of 3 mg in one hour). The duration of action is shorter than that of some benzodiazepines (e.g., diazepam) and it may require repeat dosing at 20-minute intervals. Note: Flumazenil can cause seizures in some groups of patients (chronic benzodiazepine dependent, mixed overdose, underlying seizure disorder). Use it only if supportive measures fail (i.e., assisted ventilation, stimulation) as a last resort before intubation.
- Medical assistance should be sought.

Sedative or Barbiturate Overdose

- Respiratory support: If pulse is adequate but breathing is labored or depressed:
 - Airway should be cleared. Look for oral foreign body, perform jaw thrust
 - Administer oxygen 6 L/minute by nasal cannula or face mask
 - Ventilate with mouth-to-mouth or bag valve mask if patient becomes pale or cyanotic. Insert nasopharyngeal airway and suction excess secretions
 - Intubate using cuffed endotracheal tube if above measures are unsuccessful
- Monitor vital signs.
- Medical assistance should be sought.
- IV 0.9% (normal) saline at 200 cc/h if systolic blood pressure is less than 80 mmHg.

Local Anesthetic Toxicity

Signs and Symptoms

- Early (cerebral cortical stimulation):
 - Excitement, restlessness, apprehension
 - Increased blood pressure, rapid pulse, rapid respiration
 - Nausea, vomiting, convulsions
- Late (cerebral cortical and cardiovascular depression):
 - Depressed blood pressure
 - Weak, rapid pulse or bradycardia
 - Respiratory depression, apnea, cardiac arrest

Treatment

- Patient position: Supine with legs elevated
- Medical assistance should be sought

- Oxygen 6 to 8 L/minute by mask or nasal cannula
- Respiratory support: If pulse is adequate but breathing is labored or depressed:
 - Airway should be cleared. Look for oral foreign body, perform jaw thrust
 - Oxygen 6 L/minute by nasal cannula or face mask
 - Ventilation with mouth-to-mouth or bag valve mask if patient becomes pale or cyanotic. Insertion of nasopharyngeal airway and suction of excess secretions
 - Intubation using cuffed endotracheal tube if above measures unsuccessful
- Intravenous access should be achieved to provide fluid and medicinal support
- For convulsions, patient should not be restrained but help should be given to avoid self-injury
- Avoid barbiturates which will enhance the second stage of depression
- Be prepared to begin cardiopulmonary resuscitation
- Monitor vital signs

Malignant Hyperthermia

Malignant hyperthermia is a hyper-metabolic crisis that affects humans and other animals. It is caused by a higher than normal calcium concentration in the myoplasm of muscle cells. When susceptible patients are exposed to certain substances the muscles contract uncontrollably, producing heat, carbon dioxide, and lactic acid (Figure 6.20). This results in increased metabolism, muscle rigidity, and high fever. The liver cannot clear the amount of lactate being produced and the subsequent

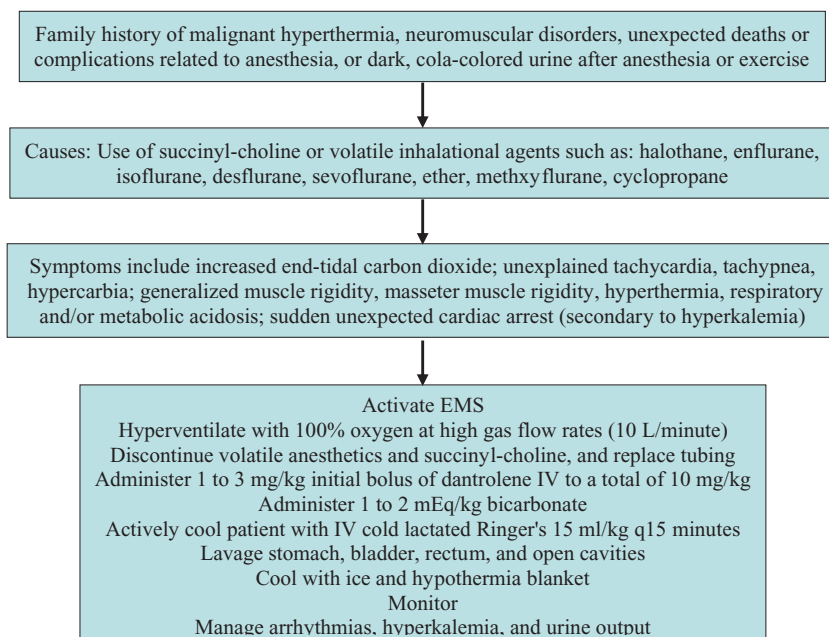


Figure 6.20. Malignant hyperthermia.

metabolic acidosis overwhelms the body's physiologic systems. Carbon dioxide increases in the early stages of malignant hyperthermia causing tachycardia and tachypnea. As muscle cells are destroyed, creatine phosphokinase increases in the blood along with myoglobin, ultimately causing renal impairment. Death may result from cardiac arrest, internal hemorrhage, or multisystem organ failure.

A history of malignant hyperthermia in the family or death of a family member after anesthesia, other neuromuscular disorders, or dark urine after surgery should prompt additional evaluation for this problem. Local anesthesia is not a cause of malignant hyperthermia, although many volatile inhalational agents are. When these substances are used, if unexplained tachycardia, tachypnea, muscle rigidity, or hyperthermia is identified, malignant hyperthermia should be suspected.

Emergency medical services should be summoned if in an office setting, or a "code" called if in a hospital outpatient or inpatient setting. The volatile anesthetic should be discontinued, hyperventilation with oxygen at high flow rates should occur, dantrolene must be administered, and the body cooled until emergency assistance arrives.

Venipuncture Complications

Venipuncture complications are not all true emergencies; however, these problems and their management are not addressed in other portions of this text. Practitioners who have the administration of intravenous medication within their scope of practice should be familiar with common problems associated with the venipuncture procedure (Appendix 27).

Extravasation of blood is a common occurrence after unsuccessful insertion of an angiocatheter (Figure 6.21). Hematoma or painful induration may result. Simple application of pressure should abate the extravasation of blood. Elevating the limb is helpful. A simple bandage can help with wound protection.

Hematoma: Apply pressure to the venipuncture site

Extravasation of fluid: Apply moist heat.
Infiltrate 1% plain lidocaine into area.
Aspirin, steroids, and antibiotics may be necessary.

Phlebitis: Aspirin, nonsteroidal anti-inflammatory drugs,
Steroids, and antibiotics may be necessary.
Application of moist heat and elevation can be helpful.

Inadvertent intra-arterial injection: Leave needle in place,
inject 1% plain lidocaine. Transport patient to hospital for vascular surgeon.

Figure 6.21. Venipuncture complications.

If the extravasation of fluids causes localized inflammation, moist heat may be applied as a palliative measure. The administration of lidocaine can help control pain in the region. Simple analgesics such as acetylsalicylic acid should suffice. Depending upon the extent, quantity, and type of fluid extravasated, steroids and antibiotics may be considered.

When diazepam was in frequent use, phlebitis was a common post-administration problem. The affected vessel will take on a palpable, cord-like, firm character. Pain is also associated with this condition. Management for this condition is similar to that for extravasation, with warm, moist compresses administered along with anti-inflammatory analgesics. Steroids and antibiotics may be required for management, if severe. In the worst cases, excision of the affected vessel is required.

Although rare, inadvertent intra-arterial injections are possible. The symptoms include pain, burning, or paresthesia along the distal distribution of the affected vessel. Blanching of the digits and tissues may result. This is a vascular emergency and should be managed by a vascular surgeon. The angiocatheter should remain in place. A local anesthetic may be administered to control pain. The local anesthetic also may relax the constricted vessel to improve perfusion. The patient should be transported to an institution with vascular surgical services.

Suggested Reading

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7 Maxillofacial Prosthetics

A hospital dental service is quite often called upon by the otorhinolaryngology, radiation therapy, speech pathology, head and neck surgery, plastic surgery and reconstructive surgery, or oral and maxillofacial surgery service to serve a supporting role in the care of the patient who requires a maxillofacial prosthesis, or to help in determining the treatment options for patients with a variety of intraoral or extraoral defects. These defects may be either congenital or acquired in their etiology. Similarly, the general dental resident might be called to assist an attending maxillofacial prosthodontist on the staff. Because dentists with formal maxillofacial training are not available in most hospitals, the general dental attending and resident staff should be familiar with the more common maxillofacial prosthetic problems and prosthesis.

Obturator Prosthesis: Types

Surgical Obturator

- Sometimes referred to as an immediate obturator
- Serves as a temporary prosthesis that is usually inserted in the operating room (theater) immediately following the surgical removal of a portion or all of the maxilla or surrounding osseous structures, including the alveolar bone
- Functions to separate the oral and nasal cavities that would otherwise communicate with each other following surgery
- Allows a patient to speak and swallow without the leakage of food and fluids from the mouth into the nasal cavity

- Usually fabricated from polymethyl methacrylate (PMMA) with wrought wire clasps engaging the remaining teeth for retention
- In edentulous situations, retention is gained by extension into the tissue undercuts created by the surgical resection
- Usually removed seven to 10 days post-resection and modified as needed as the patient continues to heal
- Eventually replaced with an interim or definitive obturator to restore the maxillary defect

Interim Obturator

- Replaces the surgical obturator after the completion of initial healing following a maxillary resection, or if no further surgery is required
- Function is similar to that of the surgical obturator. Most commonly separates the nasal, antral, and oral cavities, thereby improving a patient's ability to speak and swallow after surgery. Maxillofacial prostheses may separate the internal from external environment; for example, the nose and paranasal sinuses from the orbit
- May have a cast metal framework or be fabricated from PMMA with wrought wire clasps for retention to teeth. With the advent of implants, these may be retained via precision attachments secured to intra- and extra-oral implants
- As the margins of the surgical defect become more stable, teeth may be added, although an interim obturator may also require frequent modification
- Usually used no longer than six to 12 months and is replaced by a definitive obturator once the resection site has fully healed or no further surgery is anticipated

Definitive Obturator

- Often referred to simply as an “obturator.” Its function is to separate the oral and nasal cavities to allow the patient to eat and drink without nasal regurgitation. Also reduces the hypernasality of speech following maxillary resection. Yet, maxillofacial prostheses may also assist with closure and separation of a variety of cutaneous, mucosal, and skeletal craniomaxillofacial defects
- Used to prosthetically rehabilitate all or part of a maxilla and the associated structures removed during surgical resection
- Usually placed after nine to 12 months, once healing is complete
- Fabricated from a cast metal base (chromium–cobalt or titanium alloy) with cast clasps for retention. PMMA is processed to obturate the defect and provide soft tissue support. With the development of newer material, soft lined obturator prostheses are available. Prosthetic teeth are added for esthetics and speech. Usually there are light or no occlusal contacts on the resected side of the prosthesis
- In edentulous patients the undercuts within the defects are engaged for retention. Resilient polymer material may be processed into the undercut areas to improve retention

- Osseointegrated implants also may be placed into the alveolar bone in the non-resected maxilla for additional retention and stability in the edentulous resection patient

The Maxillary Resection Patient

Etiology and Incidence

A maxillectomy is often necessary for benign and malignant tumors of the maxillary sinus, hard palate, and often the soft palate. The extent of the surgery depends upon the size and pathology of the tumor.

It is rare to have a primary tumor of the gingiva covering the hard palate. Palatal tumors most often arise in the sinus and spread inferiorly through the sinus floor. They include:

- Squamous cell carcinoma (the most prevalent type, at approximately 80%)
- Adenocarcinoma
- Minor salivary gland tumors

Suspected etiologic agents/predisposing factors:

- Exposure to certain metal powders (chromium) or sawdust (furniture workers), chronic snuff use
- Chronic sinusitis, nasal polyps
- Ethanol
- Tobacco products

Diagnosis/Clinical Presentation

- Medial extension (into nasal cavity): Nasal discharge, congestion, epistaxis
- Inferior extension (into oral cavity): Palatal swelling, loosening of maxillary teeth, ulceration of mucosa, ill-fitting dentures
- Superior extension (into orbit): Orbital swelling, diplopia, epiphora, proptosis, unilateral fixed glaze
- Anterior extension: Facial swelling, lack of sensation in skin, unilateral pain
- Posterior extension: Otoalgia, trismus

Rationale for Immediate Obturation

Function

- Maintain palatal contours after surgery
- Provide a matrix to hold surgical packing against defect

- Immediate speech improvement
- Improve deglutition
- Improve oral nutritional intake (nasogastric tube may be removed earlier)
- Protect nasal tissues from contents of oral cavity

Psychology

- Esthetics improved as teeth may be replaced
- Phonetics are improved to permit intelligible communication
- Defect is not as readily sensed by patient
- Provides support and normal contours to soft tissues of face

Hygiene

Oral and nasal cavities are separated, thus preventing nasal regurgitation of food and liquids. This also maintains these two ecological units with their different bacterial flora.

Presurgical Treatment Planning

There is often very little time between the request for a dental consultation and the actual surgical procedure. It is imperative that a proactive working relationship exist between the dental service and the requesting surgical service. This allows for a thorough discussion of the proposed surgical resection, with consideration given to improving the postsurgical prosthetic rehabilitation.

Initial Dental Evaluation

- Review the history of the present illness, past medical and surgical history, social history, and alcohol and tobacco use for information relevant to the condition and prognosis
- Review the prior dental history:
 - Hygiene regimen
 - Frequency and nature of past dental care
 - Prior experience with removable dental prostheses
- Obtain orthopantomographic and periapical radiographs to evaluate the teeth to be used for abutments, and plan appropriate treatment of carious and/or periodontally involved teeth. The potential for implant support can be considered at this time
- Obtain intraoral and extraoral presurgical photographs as part of the patient's medical record
- Fixed dental bridgework may need to be sectioned if it spans a region where a surgical resection will be made

- Obtain two sets of impressions (both maxilla and mandible) and pour both in dental stone. Obtain an interocclusal record:
 - Impression trays may require modification with wax or compound to accommodate all landmarks if tumor is extensive
 - One set of casts serves as diagnostic casts
 - One set serves as working laboratory casts
- Abutment teeth should be identified to retain the surgical prosthesis. Modifications should be made to improve retention if indicated:
 - Survey appropriate undercut regions
 - Recontour teeth to improve undercuts
 - Restorations may be placed to alter undercuts
 - Consider dimples, grooves, and rests for additional retention
- Consider implants
- Select and record the appropriate mold and shade of teeth if they are to be included on the prosthesis
- If a resection of extraoral facial tissues is anticipated, a facial moulage (mold) also may be obtained; this is supported with a plaster or acrylic backing to prevent distortion. It will serve as a presurgical record for postsurgical prosthetic rehabilitation

Dental–Surgical Treatment Planning Analysis

The member of the dental service responsible for the patient's care should meet with a member of the surgical service performing the maxillary resection to discuss the planned procedure and any possible deviations from the plan that may be anticipated. The articulated diagnostic casts and radiographs should be available for the team to thoroughly discuss the patient's condition and surgical/rehabilitative plan. The definitive rehabilitative plan should be developed before surgery.

The surgeon should outline on the cast the proposed incisions. The dentist should advocate the following points:

- Consideration should be given to retaining as many sound teeth as possible without compromising disease-free surgical margins
- Osseous structures should be preserved (i.e., anterior hard palate) if possible, again without compromising disease-free surgical margins
 - If implants are considered, they should be placed at the time of surgery, before permanent bone damage from therapeutic radiation.
- The incisions should be made through a socket where a tooth has been extracted to increase the support around the terminal abutment tooth.

The need for supplemental retention by transosseous or interdental wire, or preferably titanium screw fixation, should be discussed for edentulous patients. These include transalveolar vs. circumzygomatic vs. piriform aperture vs. interdental vs. palatal screw placement.

If postsurgical radiation therapy is anticipated by the surgeon or oncologist, teeth with a questionable prognosis should be removed in time to allow for healing prior to the start of radiation therapy. All carious lesions in teeth deemed to have a fair or better prognosis should be restored.

Immediate Surgical Obturator

Laboratory Procedures

Usually, due to time constraints, the fabrication of the actual prosthesis is done at the hospital in the dental laboratory. If adequate time is available prior to surgery, the articulated casts and a detailed laboratory prescription may be sent to a commercial laboratory familiar with the fabrication of obturator prosthesis.

Cast Modification

- The teeth in the area of resection are removed and the ridge portion of the cast is contoured to resemble an edentulous alveolar ridge
- Where the soft palate is also to be resected, the soft palate on the working cast should be reduced to the level of the hard palate, simulating the position of the dynamic soft palate during function, rather than interfering with the function of the tongue
- Wrought wire clasps are formed to engage the undercuts on the identified abutment teeth and held in place with sticky wax
- If there is adequate time for flasking and processing with heat-cured methyl methacrylate, the palatal portion should be waxed to a thickness of 2 to 3 mm across the hard palate and defect area. Teeth may be waxed into place in the anterior region. Care should be taken in designing and fabricating the prosthesis to minimize the adjustment required in the operating room (theater)
- If there is minimal time prior to surgery, the prosthesis may be directly fashioned by the “sprinkling method” of adding small amounts of cold-cure methyl methacrylate powder and monomer liquid directly onto a well-lubricated cast
- Both the heat-processed and cold-cured prostheses are then trimmed and polished. Recessed holes are drilled with a number 8 round bur in a slow speed handpiece in the region where supplemental ligature wires will be needed
- The completed prosthesis is clearly labeled with the patient’s name and sent to the operating room (OR) along with the instruments necessary for inserting and securing the prosthesis. Ideally, both should be sterilized or decontaminated prior to surgery. Again, if time does not allow for gas sterilization of the prosthesis, it may be delivered to the OR and cold-sterilized immediately prior to insertion
- Instruments required for prosthesis placement:
 - Dental mirror, explorer, needle holders (two), wire directors (two), wire cutter, band pusher, surgical awl, and multiple pieces of 16- and 18-gauge stainless steel ligature wire
 - Hall drill and multiple burs for modifying the prosthesis

Surgical Procedures

Whenever possible, the dentist fabricating the immediate prosthesis should be present in the operating room to place or assist in placing the surgical obturator. The prosthesis is inserted following the surgical resection and the placement of a skin graft to line the defect

- Check fit and retention first: There should be no over extension which would place tension across the surgical flap:
 - Necessary modifications should be made with the Hall drill away from the surgical field
 - The modified prosthesis is rinsed with sterile normal saline and again fitted to the surgical site
- If additional retention is required, interdental ligature wires may be placed or transosseous wires or a transpalatal screw placed in the case of the edentulous patient
- Once the prosthesis is secured to the surgical site, the surgical packing and nasogastric tube is placed by the surgeon and the flap closed to complete the procedure

Postsurgical Care

The patient is seen daily by the dental service while hospitalized:

- Check prosthesis for stability, retention
- Check patient for comfort, speech quality, ability to swallow, nasal leakage of food and fluids
- Oral hygiene measures are stressed to the patient and nursing staff.

The immediate prosthesis is removed seven to 14 days after surgery, depending upon the patient's healing progress and the extent of the resection. This is often a joint appointment with both the dentist and surgeon present.
- Local anesthetic may be required when removing ligature wires or intraosseous screws
- Wires should be cut with a bur and/or a wire cutter
- The prosthesis is carefully removed along with surgical packing and cleaned with an antibacterial soap and water to remove any gross debris. This may be followed by ultrasonic cleansing
- Reline the defect area of the prosthesis with a soft reline material or tissue conditioner to assist in retention and to obturate the defect. In situations where the defect is large this may require several sequential relines to achieve the necessary obturation
- Instruct the patient how to insert and remove the prosthesis. The patient should be able to demonstrate the ability to insert and remove the prosthesis before dismissal
- Upon discharge from the hospital, the patient is directed to return for modification of the prosthesis in seven to 10 days

Mandibular Resection Patient with Immediate Microvascular Reconstruction

The patient requiring surgery to resect a tumor of the mandible is most effectively treated with a microvascular reconstruction using either the fibula, radius, or iliac crest, ideally with osseointegrated implants through either an immediate or delayed approach. Ideally, the autogenous reconstruction and subsequent prosthetic rehabilitation should be planned prior to the resection. Proper planning and dental service input will help assure the proper positioning of the osseous structures used to reconstruction the defect and help in providing a functional removable or fixed-removable prosthesis.

Speech Aid Prosthesis

A speech aid prosthesis is also referred to as a speech “bulb” or simply a speech appliance. It can be indicated for both children and adults. Speech aid prostheses are used primarily to improve speech quality in cleft palate patients by obturating a palatal cleft or fistula. They can also assist in improving speech quality in patients with velopharyngeal incompetency (VPI), such as cleft palate patients, stroke patients with neurogenic VPI, or head and neck cancer patients who may have VPI following tumor resection.

They consist of three components:

- A PMMA palatal plate, retained by either wrought wire or cast clasps, is the primary retentive element of the entire prosthesis
- A stainless steel 0.050-inch wire extends from the palatal portion to traverse the soft palate and project into the region of the junction of the oro- and nasopharynx
- An acrylic pharyngeal “bulb” is fashioned from PMMA to sit at the level of the tubercle of the atlas and close off the oropharynx from the nasopharynx at appropriate times during speech and swallowing

The palatal portion and the pharyngeal extension can also be fabricated in a cast framework. Modifications to the bulb are made on a frequent basis because the quality of speech can change, especially in pediatric cleft palate patients.

The pharyngeal extension may be retained by a projection on the major connector of a cast partial denture framework.

Palatal Lift Appliance

- Cerebrovascular accidents are perhaps the most common cause of soft palate incompetency
- The appliance serves to elevate the soft palate to assist in velopharyngeal closure during speech and swallowing, thereby effectively serving to separate the oro- and nasopharynx at the appropriate times

- It is indicated when the primary deficit in the velopharyngeal mechanism is in the soft palate alone
- Increased velopharyngeal closure enhances vocal projection and provides a reduction in hypernasality
- The appliance includes either a cast metal or PMMA hard palatal portion with retention from wrought wire or cast metal clasping. A beaver-tail-shaped elevated portion, fabricated from PMMA, extends from the hard palate section and gently “lifts” the soft palate
- The function of the palatal lift also can be achieved with the speech aid appliance
- If extensive palatal lift is required, retention may be inadequate to use the palatal lift appliance
- A successful palatal lift prosthesis depends on adequate teeth to retain the prosthesis and counter the downward displacing forces of the soft palate. With the advent of osseointegrated implants, edentulous palatal lift prostheses have become successful
- They may be fabricated using an existing removable prosthesis if the patient has one (or two)

Palatal Augmentation Prosthesis

Following a surgical resection of the tongue or after a stroke, the loss of mass and the lack of coordination of the intrinsic muscles of the tongue might not allow the organ to be properly positioned relative to the hard palate, thus compromising speech production and swallowing efficiency. A palatal augmentation prosthesis:

- Allows the palate to be reshaped and improves the tongue-to-palate relationship
- Improves speech and swallowing by the most efficient contact of the dorsal surface of the tongue with the prosthesis
- Is made from PMMA and retained by cast or wrought wire clasps around the maxillary teeth

Low fusing wax is added to the tongue surface of the prosthesis and the patient is allowed to mold the wax to conform to the shape of the dorsum of the tongue. The wax is then processed in PMMA.

Cleft Plate Molding Appliance

The newborn infant with a cleft palate, whether unilateral or bilateral, suffers from a number of hard and soft tissue deficits in the nasolabial region. With the segments of the maxillary alveolus separated by the cleft, the infant often has great difficulty feeding. Surgery is required to close the defect in the lip and repair the palatal cleft.

- A cleft palate molding appliance resembles a small maxillary denture, which functions to close the palate and separate the oral and nasal cavities and thus allows the baby to create a vacuum by suckling, thereby improving feeding

- May be modified on a weekly basis as well to mold the alveolar segments closer together as the child grows rapidly
- When properly molded, the appliance is capable of producing a normal, symmetrical maxillary alveolar arch-form while reducing the size of the cleft. This reduces the extent and complexity of the surgical repair of the cleft of the lip (if present), which is usually performed at approximately two to four months of age
- Reduces the extent of the surgical repair of the palate as well. Palate repair usually is delayed until the first attempt at speech production at six to 14 months
- Fabricated by obtaining an impression of the maxilla and defect with an elastomeric impression material, not alginate, which may easily tear, leaving material in the defect that may be swallowed or lodged in the infant's airway. The cleft palate molding plate is then fashioned on the recovered stone cast using polymethyl methacrylate
- The plate is usually self-retentive but may also be retained by palatal pins (Latham appliance) or with adhesive suture strip tape placed across the maxillary lip

Gunning (Fracture) Splint

Gunning (fracture) types of splints are effective if rigid internal fixation cannot be accomplished. They allow for the surgical reduction and fixation of fractures of the edentulous maxilla or mandible that are difficult because it is impossible to orient the bony segments properly. The splint also can be fabricated to assist in positioning the jaw segments during orthognathic surgery for edentulous or partially edentulous patients.

- The splints are fabricated from PMMA in a fashion similar to denture fabrication. Arch bars may be incorporated into the PMMA
- The splints have openings to allow for speech, nutrition, and saliva flow

Radiation Carrier

A radiation carrier is a device that holds a radiation source in the same position relative to the tumor or tissue intended to receive the radiation dosage. The carrier may be a set of dentures or a denture-like appliance that can hold seeds or needles of a radiation source (i.e., radium, indium, cesium). They are also referred to as carrier prostheses, radiation carriers, or radiotherapy prostheses.

Extraoral Prostheses

Facial Prosthesis

A facial prosthesis is a removable prosthesis used to replace missing or damaged facial structures due to surgery, trauma, or congenital absence. The facial prosthesis is sometimes inappropriately referred to as a prosthetic dressing.

- It is prescribed when a defect is too large or complex to allow surgical reconstruction of the area or when recurrence of a tumor is a possibility
- The prosthesis allows a patient to function in society on a day-to-day basis by restoring facial form and complexion
- It can be fabricated from a variety of prosthetic materials, silicone is the most common, but they can be fashioned from PMMA
 - The materials are colored both intrinsically and extrinsically to simulate the complexion of the surrounding tissues
- The prosthesis is retained by medical-grade silicone adhesives, double-sided tape, extension into the mechanical undercuts of the defect, or transcutaneous osseointegrated implants placed into the surrounding facial bones

Facial Moulage (Face Mask) Impression

The facial moulage impression is used to record the form and contours of the soft tissues of the face. It produces a negative image of the facial form, from which a “positive” cast can be obtained. This is especially useful for planning facial plastic surgical procedures and recording a patient’s face prior to ablative tumor surgery.

The initial impression is made from an appropriate impression material. A layer of quickset plaster or acrylic with a gauze backing used for orthopedic fracture fixation is then placed over the setting impression material for reinforcement. The impression is then removed and poured in white dental stone or plaster of Paris. The facial moulage may be made of an entire face or be sectional, making an impression of only a desired segment of the face.

Auricular Prosthesis

- Also referred to as an ear prosthesis
- Removable prosthesis fashioned from elastomeric silicone, polyurethane or latex rubber, or PMMA
- Replaces all or part of the natural ear that may have been lost to trauma or surgical resection or may have been congenitally missing
- Serves to restore the normal form and contour of the natural ear as well as to collect sound waves for improved hearing. Not purely a cosmetic prosthesis
- May be retained with medical-grade skin adhesive, attachment to eyeglasses, or through mechanical interlocks or magnets placed on transcutaneous osseointegrated implants

Ocular Prosthesis

- Commonly referred to as an artificial eye or glass eye
- Replaces an eye missing as a result of surgical ablation, trauma, or congenital absence
- Does not replace the eyelids, the orbit, or the soft tissues surrounding the eye

- Fabricated from PMMA. In the past, glass was also used to fashion an ocular prosthesis
- If the extraocular muscles are present, an ocular prosthesis can be placed to allow the movement of the ocular to mimic the movement of the natural eye. If not intact, the ocular will not be capable of animated movement.

Orbital Prosthesis

An orbital prosthesis replaces not only the contents of the orbit with an ocular prosthesis but also the adjacent hard and soft tissues, including skin, muscle, and bone that may have been lost due to surgery or trauma. In addition to restoring a normal day-to-day appearance to the orbital region, it also seals the defect from the external environment. This serves to maintain the normal humidity and tissue moisture of the surrounding cavities, maxillary sinus, and the oral and nasal cavities.

- Fabricated from elastomeric silicone, polyurethane, or latex rubber to simulate the tissues surrounding the eye, while the eye is simulated by an ocular prosthesis
- Retained by medical-grade adhesive, double-sided tape, or mechanical undercuts within the defect. Magnets or mechanical interlocks attached to transcutaneous osseointegrated implants have successfully replaced the need for adhesives

Nasal Prosthesis

Replaces hard and soft tissues that might have been lost as a result of surgical resection, trauma, or congenital absence. In addition to restoring the normal day-to-day appearance to the nasal structures and midface region, it also serves to aid in warming and humidifying inspired air before it enters the respiratory system.

- Usually fabricated from elastomeric silicone. Polyurethane, latex rubber, and PMMA can also be used.
- Retained by medical-grade adhesive, double-sided tape, or mechanical undercuts within the defect. Magnets or mechanical interlocks attached to transcutaneous osseointegrated implants have successfully replaced the need for adhesives

Cranial Prosthesis

- Also referred to as a skull plate, a cranial implant or a cranioplasty prosthesis
- PMMA plate with a reinforcing stainless steel mesh incorporated into the processed PMMA
- Designed to replace a portion of the skull or cranium and to reestablish a separation of the overlying scalp from the dura. Also protects the exposed brain

from trauma and restores the normal contour to the cranium where the bone may have been lost by surgery, infection, trauma, or developmental anomalies

- Fashioned by obtaining an impression of the defect area
- If the segment of bone that is to be replaced is available, it may be invested in plaster, removed, and the plate processed in PMMA
- The plate also may be fashioned from computer-assisted design and computer-assisted manufacturing (CAD–CAM) through the use of a reformatted three-dimensional CT scan of the defect
- Secured to the surrounding bone with stainless steel surgical wire
- Historically, cranial prostheses also have been fabricated from surgical stainless steel, tantalum, and other biocompatible metals

Nasal Stent

A nasal stent is a removable appliance that provides support to the nasal cartilage. It is fabricated from PMMA. The stent returns form to a nose damaged from trauma or surgery which, left untreated, can lead to the collapse of the nasal ala and closure of the nostrils.

- Tissue conditioning or reline material and denture adhesives are also useful in improving retention in edentulous resection situations
- In situations where there is a severe lack of retention, the surgical obturator can be stabilized by transalveolar, piriform aperture, or circumzygomatic or temporalis wiring to secure the prosthesis. A palatal screw also can be placed into the residual hard palate
- Requires frequent modification as the surgical wound heals and changes in dimension
- Not intended for use longer than six months. It is replaced by the interim obturator or, on a long-term basis, by a definitive obturator prosthesis
- Indicated when the primary deficit in the velopharyngeal mechanism is in the soft palate alone
- Increased velopharyngeal closure enhances vocal projection and provides a reduction in hypernasality
- The appliance includes either a cast metal or PMMA hard palatal portion with retention from wrought wire or cast metal clasping. A beaver-tail-shaped elevated portion, fabricated from PMMA, extends from the hard palate section and gently “lifts” the soft palate
- The function of the palatal lift also can be achieved with the speech aid appliance
- If extensive palatal lift is required, retention may be inadequate to use the palatal lift appliance
- A successful palatal lift prosthesis depends on adequate teeth to retain the prosthesis and counter the downward displacing forces of the soft palate. Edentulous “palatal lift” prostheses are rarely successful
- May be fabricated using an existing removable prosthesis if the patient has one (or two)

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Appendix 1 Abbreviations

Clinicians should be careful when using abbreviations because of the possibility of a misinterpretation. There is no universally recognized list of abbreviations and the same abbreviation can stand for two very different words or terms. The following is a partial list of abbreviations that are often used in medical or dental charts.

Abbreviations	Clinical definitions	Abbreviations	Clinical definitions
↓	symbol for decreasing	A tach	atrial tachycardia
↑	symbol for increasing	A/C	angio cath and/or IV cath
°	symbol for degree	A/G ratio	albumin globulin ratio
<	less than	A2	aortic 2nd sound
≤	equal to or less than	aa	amino acid
=	equals	AA	atlantoaxial
>	greater than	AAA	abdominal aortic aneurysm
≥	equal to or greater than	AAROM	active assistive range of motion
A	assist, assistance	AB	abortion
ā	before	Abd	abduction
A & O	alert and oriented	abd	abdominal
A & P	auscultation and percussion	ABE	acute bacterial endocarditis
A & PROM	active and passive range of motion	ABG	arterial blood gas
A fib	atrial fibrillation	abn	abnormal
A flutter	atrial flutter	ABO	blood groups
A P & L	anteroposterior and lateral	ABW	adjusted body weight
		Abx	antibiotics

AC	antecubital	AI	aortic insufficiency
ac	before meals	AICD	automatic implantable cardioverter/defibrillator
A-C	assist control		
ACC	aortic cross clamp	AIDS	acquired immune deficiency syndrome
accel	acceleration	AIN	anterior interosseous nerve
access	accessory	AJ	ankle jerk
ACDF	anterior cervical discectomy and fusion	AK	above knee
ACE	angiotensin converting enzyme	AKA	above knee amputation
ACJT	acromioclavicular joint	ALA	delta aminolevulinic acid
ACL	anterior cruciate ligament	Alb	albumin
ACMDF	anterior cervical microdiscectomy fusion	ALC	absolute lymphocyte count
ACT	activated clotting time	ALIF	anterior lumbar interbody fusion
act	activity	alk	alkaline
AD	axis deviation	ALL	acute lymphocytic leukemia
ad lib	as desired	ALS	amyotrophic lateral sclerosis
Add	adduction	ALT	alanine aminotransferase
ADD	attention deficit disorder	alt	alternating
adeq	adequate	AMA	advanced maternal age
ADH	antidiuretic hormone	a-mask	aerosol mask
ADHD	attention deficit with hyperactivity disorder	amb	ambulate
ADL	activities of daily living	AMI	acute myocardial infarction
adm	admission/admit	AML	acute myelogenous leukemia
Admin	administration/administer	amp	ampule
ADR	adverse drug reaction	AMS	altered mental status
AE	above elbow	amt	amount
AFB	acid fast bacillus	ANA	antinuclear antibody
afeb	afebrile	anes	anesthesia
AFI	amniotic fluid index	ANF	antinuclear factor
AFO	ankle foot orthosis	angio	angiogram
AFV	amniotic fluid volume	anisocyt	anisocytosis
AGA	appropriate for gestational age	ANLL	acute nonlymphocytic leukemia
Agg	aggression	ANS	autonomic nervous system
AGL	acute granulocytic leukemia	ant	anterior
AH	auditory hallucinations		
AHF	antihemophilic factor		
AHG	antihuman globulin		

anti DNA	antibody to DNA	ASA II	American Society of Anesthesiology
anti-HAV	hepatitis A virus antibody		Physical status 2; the suffix E added to the above indicates an emergency case
anti-HBcAG	antibody to hepatitis B core antigen		
anti-HBeAG	antibody to hepatitis Be antigen	ASA III	American Society of Anesthesiology
anti-HBsAG	antibody to hepatitis B surface antigen		Physical status 3; the suffix E added to the above indicates an emergency case
ANUG	acute necrotizing ulcerative gingivitis		
AO	anterior oblique		
AODM	adult onset diabetes mellitus	ASA IV	American Society of Anesthesiology
AP	anterior-posterior		Physical status 4; the suffix E added to the above indicates an emergency case
A-P	abdominoperineal		
A-pacing	atrial pacing		
APB	abductor pollicis brevis	ASA V	American Society of Anesthesiology
APC	atrial premature contraction		Physical status 5; the suffix E added to the above indicates an emergency case
APL	abductor pollicis longus		
approx	approximate/ approximations	ASA VI	American Society of Anesthesiology
appt	appointment		
APRV	airway pressure release ventilation		Physical status 6; the suffix E added to the above indicates an emergency case
APS	acute pain service		
aPTT	activated partial thromboplastin time	ASAP	as soon as possible
AR	aortic regurgitation	ASCT	antistreptolysin-P titer
ARC	AIDS-related complex	ASCVD	arteriosclerotic cardiovascular disease
ARDS	adult respiratory distress syndrome	ASCVRD	arteriosclerotic cardiovascular renal disease
ARF	acute renal failure		
AROM	active range of motion	ASD	atrial septal defect
art	arterial/artery	ASHD	arteriosclerotic heart disease
AS	aortic stenosis		
as tol	as tolerated	ASIS	anterior superior iliac spine
ASA I	American Society of Anesthesiology	ASL	American sign language
	Physical status 1; the suffix E added to the above indicates an emergency case	ASMA	anti-smooth muscle antibody
		ASMI	anterior septal myocardial infarction

ASO titer	anti-streptolysin-O titer	BBSH	bilateral breath sounds heard
asp	aspirate/aspiration	BC	bone conduction
ASPVD	arteriosclerotic peripheral vascular disease	BCAA	branched chain amino acid
assist	assistance	BCC	basal cell carcinoma
AT	anterior thigh	BCG	bacille calmette-guerin (vaccine)
ATC	around the clock	BCP	birth control pills
ATN	acute tubular necrosis	BCx	blood culture
ATNR	asymmetric tonic neck reflex	BDAE	Boston diagnostic aphasic exam
aux	auxiliary	BE	barium enema
av	arteriovenous	BED	binge eating disorder
AV	atrioventricular	BEE	basal energy expenditure
A-V	audio-visual	beta HCG	beta human chorionic gonadotrophin
AVB	atrioventricular block	Beta-II	revised beta examination
AVD	aortic valve disease	BG	blood glucose
AVF	arteriovenous fistula	BI	brain injury
aVF	augmented V lead, left leg	B-I	Billroth I
aVL	augmented V lead, left arm	BID	twice a day
AVM	arteriovenous malformation	B-II	Billroth II
AVN	avascular necrosis	bili	bilirubin
AVR	aortic valve replacement	BIP	bacterial intravenous protein
aVR	augmented V lead, right arm	BiPap	bi-level positive airway pressure
avul	avulsion	BJ	biceps jerk
ax	axillary	BJP	Bence Jones protein
B	bilateral	BK	below knee
B VI	bladder volume indicator	BKA	below knee amputation
bact	bacteria	bkfst	breakfast
BAER	brainstem auditory evoked response	bld	blood
BAL	bronchial alveolar lavage	BLE	bilateral lower extremities
BAO	basal acid output	blk	black
BASA	Boston assessment of severe aphasia	BM	bowel movement
BB	blow-by	BMCT	Bennett Mechanical Comprehension Test
BBB	bundle branch block	BMI	body mass index
BBOW	bulging bag of water	BMP	basic metabolic package
BBS	bilateral breath sounds	BMR	basal metabolism rate

BMT	bilateral myringotomy with insertion of tubes	ċ	with
BNT	Boston naming test	C 1, etc.	cervical vertebrae
BOOP	bronchiolitis obliterans organizing pneumonia	c/o	complaint of,
BOP	blood, ova, parasites	C/P	complains of
BOS	base of support	C/S	chest pain
BOW	bag of water	C/V	Cesarean section
BP	blood pressure	c/w	cervical/vaginal
BPD	bronchopulmonary dysplasia	CA	consistent with
BPH	broncho pulmonary hygiene	CAB	cancer/carcinoma
BPM	beats per minute	CABG	coronary artery bypass
BPP	biophysical profile		coronary artery bypass graft
BPPV	benign paroxysmal positional vertigo	cad	cadence
BR	bed rest	CAD	coronary artery disease
bronch	bronchoscopy	CAL	calorie
BRP	bathroom privileges	cap	capillary
BS	bedside	CAPD	continuous ambulatory peritoneal dialysis
bs	bowel sounds		capsule
BSA	body surface area	caps	caput succedaneum
BSC	bedside commode	caput succ	cardiology
BSD	bedside drainage	cardio	catheter
BSE	breast self exam	cath	Caucasian
BSMRT	bilateral submucosal resection of turbinates	cauc	CAVEAT
BSO	bilateral salpingo-oophorectomy	CAVEAT	coronary arthrectomy versus excision
BTBV	beat to beat variability		arthrectomy
BTC	bilateral tubal cauterization	CBC	complete blood count
BTHI	Brief Test of Head Injury	CBD	common bile duct
BTL	bilateral tubal ligation	CBDE	common bile duct exploration
BUFA	baby up for adoption	CBG	capillary blood gas
BUN	blood urea nitrogen	CBI	continuous bladder irrigation
BV	bacterial vaginosis	CBR	complete bed rest
BVL	bilateral vas ligation	CC	chief compliant
BW	birth weight	CC urine	clean catch urine
Bx	biopsy, behavior	CCE	cyanosis, clubbing, or edema
BXO	balanitis xerotica obliterans	CCL	critical carbohydrate level
C	Celsius	CCPD	continuous cycling
C & P	complete and pushing		peritoneal dialysis
C & S	culture and sensitivity	CDB	cough and deep breathe
		CDH	congenital
		C-Diff	diaphragmatic hernias
			clostridium difficile

CEA	carcinoembryonic antigen	CMV	cytomegalic virus
ceph	cephalic	cngd	continuous nasogastric drip
cerv	cervical	CNS	central nervous system
CES	caudal epidural steroid	CO	cardiac output
CFT	complement fixation test	coag	coagulation
CG	contact guarding	cog	cognitive
CGA	contact guard assist	COGD	continuous orogastric drip
CGL	chronic granulocytic leukemia	COHb	Carboxyhemoglobin
CHAL	central hyperalimentation	comp	compound
CHB	complete heart block	comp fixation	complement fixation
CHD	congenital heart disease	compl	complication
chemo	chemotherapy	conc	concentration
CHF	congestive heart failure	cond	condition
chg	change	cont	continuous
CHI	closed head injury	contr	contraction
CHL	conductive hearing loss	contra	contralateral
CHO	carbohydrates	Coombs I&D	Coombs indirect and direct
chol	cholesterol	COPD	chronic obstructive pulmonary disease
chr	chronic	CP	cerebral palsy
CHT	closed head trauma	CP angle	costophrenic angle
CI	cardiac index	CPAP	continuous positive airway pressure
CID	cytomegalic inclusion disease	CPB	cardiopulmonary bypass
CIN	cervical intraepithelial neoplasia	CPD	cephalopelvic disproportion
circ	circumcision	CPDD	calcium pyrophosphate deposition disease
CIS	carcinoma-in-situ	CPI	crisis prevention intervention
CK	creatinine kinase	CPK	creatinine phosphokinase
CKC	cold knife cone of cervix	CPM	continuous passive motion
CKMB	myocardial B-type isoenzyme	CPPV	continuous positive pressure ventilation
CLL	chronic lymphocytic leukemia	cps	cycles per second
CM	cardiomyopathy	CPT	chest physical therapy
CMC	carpometacarpal joint	CPT & D	chest physical therapy and drainage
CMG	cystometrogram	CR	closed reduction
CML	chronic myelogenous leukemia		
CMP	comprehensive metabolic package		

CREST	calcinosis, Raynaud's (phenomenon), esophageal (dysfunction), sclerodactyly, telangiectasia	D & I D/I D/C DA DAT (Coombs)	dry and intact debridement and irrigation discontinue ductus arteriosus direct antiglobulin test
CRF	chronic renal failure	DB	deep breathe
CRI	chronic renal insufficiency	dc'd	discharged
CRIF	closed reduction, internal fixation	DCM	dilated cardiomyopathy
CRIMF	closed reduction intermaxillary fixation	DD	delivery day
CRP	C-reactive protein	DDD	degenerative disc disease
CRPD	chronic restrictive pulmonary disease	dec	decrease
cryst	crystals	decel	deceleration
CSC	child service coordination	decond	deconditioned
C-section	Cesarean section	decub	decubitus
CSF	cerebrospinal fluid	defic	deficiency
C-spine	cervical spine	deg	degree
CST	contraction stress test	del	delivery
Cst	static compliance	demo	demonstrate
CT	computerized tomography	dep	dependent
CTA	clear to auscultation	derm	dermatology
CTR	carpal tunnel release	DES	diffuse esophageal spasm
CTS	carpal tunnel syndrome	dev	developmental
CTXN	contractions	dev delay	developmental delay
CUC	chronic ulcerative colitis	DF	dorsiflexion
cult	culture	DFS	decreased functional status
CV	cardiovascular	diag	diagnosis
CVA	cerebrovascular accident	DIC	disseminated intravascular coagulation
CVD	cardiovascular disease	diff	differential
CVL	central venous line	DIP	distal interphalangeal
CVP	central venous pressure	disloc	dislocation
CWO	chest wall oscillation	dist	distention
Cx	circumflex	DJD	degenerative joint disease
CXR	chest X-ray	DKA	diabetic ketoacidosis
cysto	cystoscopy	DLCO	carbon monoxide diffusion capacity
D & C	dilation and curettage	DM	diabetes mellitus
D & E	dilation and evacuation	DME	durable medical equipment
		DNA	deoxyribose nucleic acid

DNKA	did not keep appointment	echo	echocardiogram
DNR	do not resuscitate	ECMO	extra-corporeal membrane oxygenation
DOA	dead on arrival		
DOB	date of birth	ECRB	extensor carpi radialis brevis
DOD	date of death		
DOE	dyspnea on exertion	ECRL	extensor carpi radialis longus
DP	dorsalis pedis		
dp	dorsoposterior	ECT	electroconvulsive therapy
DPI	dry powder inhaler		
DPNS	deep pharyngeal neuromuscular stimulation	ECU	extensor carpi ulnaris
		EDB	extensor digitorum brevis
DPOAE	distortion product otoacoustic emissions	EDC	extensor digitorum communis
DPT	diphtheria, pertussis, and tetanus	EDD	estimated date of delivery
DSAB	differential subarachnoid block	EEG	electroencephalogram
DSD	dry sterile dressing	EENT	eyes, ears, nose, and throat
dsg	dressing		
DT	diphtheria, tetanus	EF	ejection fraction
DTR	deep tendon reflexes	EFA	essential fatty acids
DT's	delirium tremors	eff	effacement
DU	duodenal ulcer	EFL	Extensor Flexor Longus
DUB	dysfunctional uterine bleeding	EFM	external fetal monitor
		EFVC	expiratory flow-volume curve
DV	domestic violence		
DVT	deep vein thrombosis	EFW	estimated fetal weight
Dx	diagnosis	EGA	estimated gestational age
Dz	disease		
EAA	essential amino acids	EGD	esophagogastro-duodenoscopy
EAB	elective abortion		
EAC	external auditory canal	EHL	extensor hallucis longus
EAM	external auditory meatus		
		EJ	external jugular
EAP	extrinsic allergic pneumonia	EKG	electrocardiogram
		ELOS	estimated length of stay
EBBSH	equal bilateral breath sounds heard		
		EM	ejection murmur
EBL	estimated blood loss	EMD	electromechanical dissociation
EBP	epidural blood patch		
EBV	Epstein-Barr virus	emerg	emergency
EC	enteric-coated	EMG	electromyogram
ECC	endocervical curettage	EMS	electrical muscle stimulation
ECCE	extracapsular cataract extraction		
		ENA	extractable nuclear antigen
ECG	electrocardiogram		

enc	encourage	F/C	fever/chills
endo	Endoscopy	F/S	full strength
ENG	electronystagmography	F/U	follow up
ENT	ears, nose, throat	FA	forearm
EOA	esophageal obturator airway	FANA	fluorescent antinuclear antibody
EOM	extraocular movement	fas	fetal acoustic stimulation
EP	ectopic pregnancy	FB	foreign body
EPAP	expiratory positive airway pressure	FBG	fasting blood glucose
EPB	extensor pollicis brevis	FCE	Functional Capacity Evaluation
epis	episiotomy	FCR	flexor carpi radialis
epith	epithelial	FD	fetal distress
EPL	extensor pollicis longus	FDP	fibrin degradation product
EPS	electrophysiologic studies	FDS	flexor digitorum sublimis
ER	external rotation	FEF	forced expiratory flow
ERCP	endoscopic retrograde cholangiogram	fem-pop	femoropopliteal bypass
ERV	expiratory reserve volume	fem V	femoral vein
ES	electrical stimulation	FES	functional electric stimulation
ESI	epidural steroid injection	FESS	functional endoscopic sinus surgery
ESR	erythrocyte sedimentation rate	FEV	forced expiratory volume
ESRD	end-stage renal disease	FEV1	forced expiratory volume, 1 second
ESWL	extracorporeal shock wave lithotripsy	FEV2	forced expiratory volume, 2 seconds
ET	endotracheal	FF	fundus firm
ETA	estimated time of arrival	FF@U	fundus firm at umbilicus
ETCO2	end tidal carbon dioxide	FFB	flexible fiberoptic bronchoscope
ETOH	alcohol, ethanol	FFP	fresh frozen plasma
ETR	education teaching record	FH	fetal heart
ETT	endotracheal tube	FHL	flexor hallucis longus
EUA	exam under anesthesia	FHR	fetal heart rate
ExF	expiratory force	FHT	fetal heart tone
exp lap	exploratory laparotomy	fib	fibula
expir	expiration	FIM	Functional Independence Measure
ext	external	FIO2	fractional concentration inspired
EXT	extension		oxygen
F	Fahrenheit		flexion
F Hx	family history	flex	

fluoro	fluoroscopy	GE	gastroenterology
FM	fetal movement	GEMS	general extended mental status examination
FMC	fetal movement count		
FOB	foot of bed		
FP	frontoposterior	gen anes	general anesthesia
FPB	flexor pollicis brevis	GERD	gastro-esophageal reflux disorder
fs	fingerstick		
FSBG	fingerstick blood glucose	gest	gestation
FSE	fetal scalp electrode	GG	gamma globulin
FSH	follicle stimulating hormone	GGT	gamma glutamyl transpeptidase
FTA	fluorescent treponemal antibody	GI	gastrointestinal
FTA-ABS	fluorescent treponemal antibody absorption test	GIN	Gas injected nebulizer
		GIP	gastric inhibitory polypeptide
FTN	finger to nose	Gm	gram
FTNB	full-term newborn	GOAT	Galveston Orientation and Amnesia Test
FTND	full-term normal delivery	GONB	greater occipital nerve block
FTNSD	full-term, normal, spontaneous delivery	GOO	gastric outlet obstruction
FTP	failure to progress	GSW	gunshot wound
FTSG	full-thickness skin graft	GT	gastrostomy tube
FTT	failure to thrive	gtt	drop
FUB	functional uterine bleeding	GTT	glucose tolerance test
funct	functional	GU	genitourinary
FUO	fever of unknown origin	GW tongs	Gardner Wells tongs
FV cath	femoral vein catheter	H & H	hemoglobin and hematocrit
FVC	forced vital capacity	H & L	heart and lungs
FVEP	flash visual evoked potential	H & P	history and physical
FWB	full weight bearing	H/A	headache
Fx	fracture	h/o	history of
G	gravida	HAV	hepatitis A virus
GA	gestational age	HB	heart block
GB	gallbladder	Hbab	hepatitis antibody
GBS	group B strep	HBcAg	hepatitis B core antigen
GC	gonococcus (gonorrhea)	HBeAg	hepatitis B e antigen
GCS	Glasgow Coma Scale	HBIG	hepatitis B immune globulin
GCT	general clerical test	HBP	high blood pressure
GDM	gestational diabetes mellitus	HBsAg	hepatitis B surface antigen
		Hct	hematocrit
		HCVD	hypertensive cardiovascular disease

HD	heart disease	hor abd	horizontal abduction
HDL	high density lipoproteins	hor add	horizontal adduction
HDPD	heart disease prevention diet	HPI	history of present illness
HE	hearing evaluation	HPV	human papilloma virus
HEENT	head, eyes, ears, nose, throat	HR	heart rate
HELLP	hemolysis, elevated liver enzymes, and low platelet hemoglobin	hs	bedtime
hep	hepatic	HSBG	heelstick blood glucose
HEP	home exercise program	HSG	hysterosalpingogram
HF	heart failure	HSM	hepatosplenomegaly
Hgb	hemoglobin	HSV	herpes simplex virus
HgB-A1C	glycosylated hemoglobin	HTD	Hand Tool Dexterity Test
HGH	human growth hormone	HTN	hypertension
HH	home health	HTS	heel-to-shin
HHD	hypertensive heart disease	HUS	hemolytic uremic syndrome
HHN	hand held nebulizer	HVD	hypertensive vascular disease
HHNK	hyperosmolar hyperglycemic non-ketotic coma	HVOT	Hooper Visual Organization Test
HIE	hypoxic ischemic encephalopathy	Hx	history
Hisp	Hispanic	hyperal	hyperalimentation
histo	histology	hyst	hysterectomy
HIV	human immunodeficiency virus	HZV	herpes zoster virus
HJB	Howell-Jolley body	I	inspiratory
HJR	hepatojugular reflux	I & D	incision and drainage
HL	hearing level	I & O	intake and output
HLA	human leukocyte antigen	①	independent
HLP	hyperlipoproteinemia	I:E	inspiratory:expiratory
HMD	hyaline membrane disease	IA	intra-aortic
HNP	herniated nucleus pulposus	IABC	intra-aortic balloon catheter
HO	heterotropic ossification	IABP	intra-aortic balloon pump
HOB	head of bed	IAC	internal auditory canal
HOH	hard of hearing	IADHS	inappropriate antidiuretic hormone syndrome
		IAM	internal auditory meatus
		IBD	inflammatory bowel disease
		IBS	irritable bowel syndrome
		IBW	ideal body weight
		IC	intercostal
		ICB	intracranial bleed

ICBG	iliac crest bone graft	IPAP	inspiratory positive
ICCE	intracapsular cataract		airway pressure
	extraction	IPPB	intermittent positive
ICH	intracranial		pressure breathing
	hemorrhage	IPPV	intermittent positive
ICM	intercostal margin		pressure ventilation
icp	intermittent	IR	internal rotation
	catheterization	IRGDM	insulin requiring
	program		gestational diabetes
ICP	intracranial pressure		mellitus
ICS	intercostal space	IRV	inspiratory reserve
ICSH	interstitial cell-		volume
	stimulating hormone	IS	incentive spirometry
ID	intradermal	ITP	idiopathic
IDDM	insulin dependent		thrombocytopenic
	diabetes mellitus		purpura
IF	iliac fossa	IU	intrauterine
Ig	immunoglobulin	IUD	intrauterine device
IH	inguinal hernia	IUGR	intrauterine growth
IHSS	idiopathic		restriction
	hypertrophic subaortic	IUP	intrauterine pregnancy
	stenosis	IUPC	intrauterine pressure
IM	intramuscular		catheter
IMA	inferior mesenteric artery	IV	intravenous
IMF	internal mandibular	IV	intravenous
	fixation	cholangio-	cholangiogram
IMI	inferior myocardial	gram	
	infarction	IVC	inferior vena cava
IMP	impression	IVCD	intraventricular
IMV	intermittent		conduction defect
	mandatory ventilation	IVD	intervertebral disc
inc	incision	IVDA	intravenous drug
incont	incontinent		abuse
indep	independent	IVF	intravenous fluids
inf	inferior	IVH	intraventricular
ing	inguinal		hemorrhage
inj	injection	IVP	intravenous pyelogram
inpt	inpatient	IVPB	intravenous piggyback
int	internal	J	jugular
inv	inversion	j-tube	jejunostomy tube
IOC	intraoperative	jct	junction
	cholangiogram	JP	Jackson Pratt
IOFB	intraocular foreign	JR	junctional rhythm
	body	JRA	juvenile rheumatoid
IOL	induction of labor		arthritis
IOP	intraocular pressure	jt	joint
IOT	intraocular tension	JVD	jugular venous
IP	interphalangeal		distention

KAFO	knee ankle foot orthosis	lig	ligament
Kcal	Kilocalorie	LIMA	left internal mammary artery
KI	knee immobilizer	liq	liquid
KJ	knee jerk	LLA	left lateral arm
KUB	kidney, ureter, and bladder, flat plate abdomen	LLB	long leg brace
KVO	keep vein open	LLC	long leg cast
L	left	LLE	left lower extremity
L & A	light and accommodation	LLL	left lower lobe
L 1, etc.	lumbar vertebrae	LLQ	left lower quadrant
LA	left atrial	LMP	last menstrual period
LAC	long arm cast	LOA	lysis of adhesions
LAD	left anterior descending coronary artery	LOC	level of consciousness
LADD	left anterior descending diagonal coronary artery	LOS	length of stay
LALT	left anterior lateral thigh	LP	lumbar puncture
lami	laminectomy	LQ	lower quadrant
lap	laparotomy	LS	lumbosacral
lat	lateral	LSB	lower sternal border
LBP	lower back pain	LSK	liver, spleen, kidney
LBW	low birth weight	LSO	lumbo-sacral orthosis
LCA	left coronary artery	LTCS	low transverse Cesarean section
LCL	lateral collateral ligament	LTG	long-term goal
LD	learning disability	LTV	long-term variability
LDH	lactate dehydrogenase	LUE	left lower extremity
LDL	low-density lipoproteins	LUQ	left upper quadrant
LDOTA	language disorder other than aphasia	LVAD	left ventricular assist device
LE	lower extremity	LVAS	left ventricular assist system
LEEP	loop electrosurgical excision procedure	LVD	left ventricular dysfunction
LES	lower esophageal stricture	LVED	left ventricular end diastolic pressure
LF	low forceps	LVEF	left ventricular ejection fraction
LFD	low forceps delivery	LVG	left ventrogluteal
LFT	liver function test	LVH	left ventricular hypertrophy
LGA	large for gestational age	LVL	left vastus lateralis
LH	luteinizing hormone	LWBS	left without being seen
		lytes	electrolytes
		M & T	myringotomy and tube (s)
		Ⓜ	murmur
		M/S	musculoskeletal
		MAC	minimum/minimal alveolar concentration

MAE	moves all extremities	MPAP	mean pulmonary artery pressure
MAP	mean arterial pressure	MPI	maximum point of impulse
MAR	medication administration record	MR	mitral regurgitation
MAST	military anti-shock trousers	MRA	magnetic resonance angiogram
MAT	multifocal arterial tachycardia	MRI	magnetic resonance imaging
MAV	mechanically assisted ventilation	MRSA	methicillin resistant staph aureus
max	maximum	MS	multiple sclerosis
MBS	modified barium swallow study	MSC	midsystolic click
MC	metacarpal	MSL	midsternal line
MCA	middle cerebral artery	MT	metatarsal
MCC	motorcycle collision	MTP	metatarsophalangeal
MCL	medial collateral ligament	MUGA	multigated angiogram
MCP	metacarpophalangeal	MV	mitral valve
MCTD	multiple connective tissue disorder	MVA	motor vehicle accident
MD	muscular dystrophy	MVC	motor vehicle collision
MDI	metered dose inhaler	MVP	mitral valve prolapse
mec	meconium	MVR	mitral valve replacement
mets	metastases	MVS	mitral valve stenosis
MF	mid forceps	MVV	maximum voluntary ventilation
mf	midfrontal	N/A	not applicable
MFD	mid forceps delivery	N/V	nausea and vomiting
MFR	myofascial release	NAD	no acute distress
MI	myocardial infarction	NAS	no added salt
micro	microscopic	NB	newborn
min	minimal	NBW	normal birth weight
MIRP	Myocardial Infarction Rehabilitation Program	NC	nasal cannula
ML	middle lobe	NCAT	normocephalic/atraumatic
MMK	Marshall-Marchetti-Krantz procedure	NCV	nerve conduction velocity
MMPI	Minnesota Multiphasic Personality Inventory	neb	nebulizer
MMSE	Mini Mental Status Exam	NEC	necrotizing enterocolitis
MMT	Manual Muscle Test	NET	nasoendotracheal tube
MN	Midnight	NG	nasogastric
MNB	myoneural block	NIDDM	non-insulin dependent diabetes
mono	mononucleosis	NIF	negative inspiratory force
MP	mentum posterior	NJ	nasojejunal
		NKA	no known allergies

NKDA	no known drug allergies	PAD	pulmonary artery disease
nl	normal	PADP	pulmonary artery diastolic pressure
NP	nasopharynx	PAF	paroxysmal atrial fibrillation
NPO	nothing by mouth	palp	palpable
NR	non-rebreathing	Pap	Papanicolaou cytology smear
nrb	nerve root block	PASP	pulmonary artery systolic pressure
NSR	normal sinus rhythm	PAT	pregnancy at term
NSST	nonspecific ST wave changes	Pb	atmospheric pressure
NST	non-stress test	PBI	protein bound iodine
NSVD	normal spontaneous vaginal delivery	pc	after meals
NT	nasotracheal	PCA	patient controlled analgesic
NTS	nasotracheal suction	pcea	patient controlled epidural anesthesia
NV	neurovascular	PCIRV	pressure control inverse ratio ventilation
NWB	non-weight bearing	PCL	posterior cruciate ligament
O & P	ova and parasites	pCO ₂	partial pressure of carbon dioxide in blood gases
ø	none	PCV	pressure control ventilation
Oa	occiput anterior	PCVC	percutaneous central venous catheter
OAG	open angle glaucoma	PCWP	pulmonary capillary wedge pressure
OBS	organic brain syndrome	PCXR	portable chest X-ray
obst	obstruction	PD	peritoneal dialysis
occ	occasional	PDA	patent ductus arteriosus
OCD	osteal chondral defect	PDI	psychomotor disability index
OCG	oral cholecystogram	PDPH	post dural puncture headache
OCP	oral contraceptive pills	PE	pulmonary embolus
OCT	Oxytocin Challenge Test	pe SPL	peak equivalent sound pressure level
OD	overdose	PEA	pulseless electrical activity
OG	orogastric	PEC	permanent epidural catheter
OM	obtuse marginal coronary artery		
OOB	out of bed		
op	occiput posterior		
ORIF	open reduction internal fixation		
OMFS	oral/maxillofacial		
ot	occiput transverse		
outpt	outpatient		
P	para		
ã	after		
P F	plantar flexion		
P2	pulmonic 2nd sound		
PAC	premature atrial contraction		

PED	pulmonary edema	PMSV	Passy-Muir® Speaking Valve
PEEP	positive end expiratory pressure	PMV	Passy-Muir® Valve
PEFR	peak expiratory flow rate	pnc	prenatal course
PEG	percutaneous endoscopic gastrostomy	PND	paroxysmal nocturnal dyspnea
PEJ	percutaneous endoscopic jejunostomy	po	by mouth
perf	perforation	POC	plan of care
peri	perineal	POD	postoperative day
PERL	pupils equal and react to light	PORP	partial ossicular replacement prosthesis
PERRLA	pupils equal, round, and reactive to light and accommodation	post	posterior
PET	positron emission tomography	PP	postpartum
PFT	pulmonary function test	PPBG	postprandial blood glucose
Pg	picograms	PPD	packs per day
PHAL	peripheral hyperalimentation	PPM	permanent pacemaker
PI	present illness	PPN	peripheral parenteral nutrition
PICC	peripherally inserted central catheter	PPROM	prolonged premature rupture of membranes
PID	pelvic inflammatory disease	PPV	post pressure ventilation
PIH	pregnancy-induced hypertension	pr	per rectum
PIN	posterior interosseous nerve	PRB	partial rebreather
PIP	proximal interphalangeal	PRBC	packed red blood cells
PJC	premature junctional contraction	pre med	premedication
PKU	phenylketonuria	prec	precaution
PLIF	posterior lumbar interbody fusion	preg	pregnant, pregnancy
PLT	platelets	primip	woman bearing first child
PMB	post menopausal bleeding	PRN	as needed
PMH	past medical history	proc	procedure
PMI	point of maximal impulse	procto	proctoscopy
PMS	premenstrual syndrome	PROM	passive range of motion
		pron	pronation
		prosth	prosthesis
		prox	proximal
		PRVC	pressure regulated volume control
		PRVEP	pattern reversal evoked potential
		PS	pulmonary stenosis
		PSA	prostate specific antigen
		PSC	posterior subcapsular cataract

PSH	past surgical history	RAIU	radioactive iodine
PSIS	posterior superior iliac spine		uptake
PSP	phenolsulfonphthalein test	RALT	right anterior lateral thigh
PSVT	paroxysmal supraventricular tachycardia	RAP	rapid atrial pacing
PT	prothrombin time	RBC	red blood cells
PTA	percutaneous transluminal angioplasty	RBOW	ruptured bag of waters
PTC	percutaneous transhepatic cholangiogram	RD	retinal detachment
PTCA	percutaneous transluminal coronary angioplasty	RDI	recommended dietary index
PTH	parathyroid hormone	RDS	respiratory distress syndrome
PTL	pre-term labor	REEL	receptive and expressive emerging language
PTN	posterior tibial nerve	regurg	regurgitation
PTPA	percutaneous transluminal peripheral angioplasty	REM	rapid eye movement
PUD	peptic ulcer disease	reps	repetitions
pulm	pulmonary	REVS	reasonable expectation of vocational success
PVB	paravertebral block	RF	rheumatic fever
PVC	premature ventricular contraction	RGHS	resting gated heart scan
PVD	peripheral vascular disease	Rh	Rhesus factor in blood
PvO ₂	venous oxygen content	RHD	rheumatic heart disease
PVR	post void residual	RI	restrictive intervention
PWB	partial weight bearing	RIF	reduction internal fixation
PWI	pulse wound irrigation	RIJ	right internal jugular
Q 1h	every hour	RIMA	right internal mammary artery
q AM	every morning	RIND	reversible ischemic neurological deficit
qhs	every night	RLA	right lateral arm
QID	four times a day	RLE	right lower extremity
quad	quadriceps	RLL	right lower lobe
quant	quantity	RMSF	Rocky Mountain spotted fever
R	right	RNA	ribonucleic acid
R temp	rectal temperature	ROA	right occiput anterior
R/O	rule out	ROM	range of motion
r/t	related to	ROP	retinopathy of prematurity
RA	rheumatoid arthritis	ROS	review of systems
RAI	radioactive iodine	RPGN	rapidly progressive glomerulonephritis
		RPR	rapid plasma regent

RQ	respiratory quotient	SCD	sequential compression device
RR	respiratory rate		
RSDS	reflex sympathetic dystrophy	schiz	schizophrenic
RSI	rapid sequence induction	SCI	spinal cord injury
RSV	respiratory syncytial virus	SCM	sternocleidomastoid muscle
RTC	return to clinic	SCT	stem cell transplant
RTO	return to office	SDH	subdural hematoma
RUE	right upper extremity	SE	speculum exam
rupt	ruptured	sed rate	sedimentation rate
RUQ	right upper quadrant	SEG	sono-electroencephalogram
rv	residual volume	SEM	systolic ejection murmur
RVG	right ventrogluteal	SEMG	surface electromyography
RVH	routine visiting hours	SF	stress fracture
RVL	right vastus lateralis	SGA	small for gestational age
RW	Rolling Walker		
S & S	signs and symptoms	SGB	stellate ganglion block
Ⓢ	supervision	SGC	Swan-Ganz catheter
$\bar{s}$	without	SGHS	stress gated heart scan
S/C	shower chair	SH	social history
s/e	side effect	shld	shoulder
S/O	significant other	SI	sensory integration
S/P	status post	SI joint	sacro-iliac joint
S1	1st heart sound	SIADH	syndrome of inappropriate antidiuretic hormone secretion
S2	2nd heart sound		
S3	3rd heart sound	SIDS	sudden infant death syndrome
S4	4th heart sound		
SA	sinoatrial arrhythmia	SIMV	synchronized intermittent mandatory ventilation
SAB	subarachnoid block		
SAH	subarachnoid hemorrhage	SL	sublingual
SAQ	short arc quads	SLC	short leg cast
sat	saturation	SLE	systemic lupus erythematosus
SB	sinus bradycardia	SLR	straight leg raising
SBA	stand by assist	SLWC	short leg walking cast
SBE	subacute bacterial endocarditis	SMA	superior mesenteric artery
SBFT	small bowel follow through	SMR	submucous resection
SBO	small bowel obstruction	SMRT	submucosal resection of turbinates
SBP	systolic blood pressure		
SBS	small bowel series	SNHL	sensory neuro hearing loss
SC	sternoclavicular		
scap	scapula, scapular		

SO	salpingo-oophorectomy	SWC	short walking cast
SOB	short of breath	Sx	symptoms
SOL	space-occupying lesion	syst	systolic
SOM	serous otitis media	Sz	seizure(s)
SP	suprapubic	T	temperature
sp gr	specific gravity	T & A	tonsillectomy and adenoidectomy
SPE	serum protein electrophoresis	T & C	turn and cough
SQ	subcutaneous	T & H	type and hold
SR	sinus rhythm	T & S	type and screen
SROM	spontaneous rupture of membranes	T & X	type and crossmatch
SSA	side to side anastomosis	T 1-12	thoracic
SSE	soap suds enema	TAB	therapeutic abortion
SSEP	somatosensory evoked potential	tach	tachycardia
SSS	sick sinus syndrome	TAH	total abdominal hysterectomy
ST	sinus tachycardia	TAL	tendo-achilias lengthening
staph	Staphylococcus	TAM	total active motion
STD	sexual transmitted disease	TB	tuberculosis
STG	short-term goals	TBA	to be admitted
stim	stimulation	TBI	traumatic brain injury
STJ	subtalar joint	TBLC	term birth, living child
STM	short-term memory	TCDB	turn, cough, deep breathe
STMD	short-term memory deficit	TD	thoracic duct
STON	subtalar joint neutral	TDWB	touch down weight bearing
str	straight	TE	tracheoesophageal
Strep	Streptococcus	TEC	temporary epidural catheter
STS	soft tissue swelling	TEDS	antiembolism hose
STSG	split thickness skin graft	TEE	stockings
STV	short-term variability	TEE	transesophageal echocardiogram
supin	supination	TENS	transcutaneous electrical nerve stimulation
SV	stroke volume	TEOAE	transiently evoked otoacoustic emissions
SVC	superior vena cava	TEP	tracheoesophageal puncture,
SVD	spontaneous vaginal delivery	TESI	tracheoesophageal prosthesis
SVE	sterile vaginal exam	TF	thoracic epidural steroid injection
SVN	scalp vein needle	TFT	tube feeding
SVR	systemic vascular resistance		thyroid function tests
SVT	supraventricular tachycardia		
SW	stab wound		

TG	triglyceride	TSH	thyroid stimulating hormone
THA	total hip arthroplasty	T-Spine	thoracic spine
THR	total hip replacement	TT	tilt table
TIA	transient ischemia attack	TTB	tub transfer bench
tib	tibia	TTB/SC	tub transfer bench/shower chair
TIBC	total iron binding capacity	TTN	transient tachypnea (newborn)
TID	three times a day	TUR BT	transurethral resection of bladder tumor
TKA	total knee arthroplasty	TURP	transurethral resection of prostate
TKE	terminal knee extension	TV	tidal volume
TKR	total knee replacement	TVC	true vocal cord
TL	tubal ligation	TVH	total vaginal hysterectomy
TLA	transitional living apartment	TVPS	Test of Visual Perceptual Skills
TLC	triple lumen catheter	Tx	traction
TLOA	therapeutic leave of absence	U	umbilicus
TLSO	thoracic lumbar sacral orthosis	UA	urinalysis
TM	tympanic membrane	UAC	umbilical artery catheter
TMECG	treadmill ECG	UAO	upper airway obstruction
TMJ	temporomandibular joint	UAP	upper airway patency
TMT	tarso metatarsal	UD	urethral dilatation
TNCC	talo navicular calcaneal cuboid	UE	upper extremity(ies)
TO	telephone order	UGI	upper gastrointestinal
TOA	tubo-ovarian abscess	UI	urinary incontinence
toco	tocotransducer	UL	upper lobe
tol	tolerated	unreg	unregistered
TOP	termination of pregnancy	UOP	urinary output
TOS	thoracic outlet syndrome	UOQ	upper outer quadrant
TP	total protein	UP	ureteropelvic
TPM	total passive motion	UPC	uterine pressure catheter
TPN	total parenteral nutrition	UPJ	ureteropelvic junction
TPR	temperature, pulse, and respiration	UPT	urine pregnancy test
TR	tricuspid regurgitation	UQ	upper quadrant
trach	tracheostomy tube	UR	upper respiratory
TRUS	transrectal ultrasound	ureth	urethral
TS	tricuspid stenosis	URI	upper respiratory infection
TSA	total shoulder arthroplasty	URQ	upper right quadrant
		urt	uterine resting tone
		US	ultrasound

US/ES	ultrasound with electrical stimulation	VFC	visual form constancy
USA	unstable angina pectoris	VFG	visual figure ground
USB	upper sternal border	VFib	ventricular fibrillation
USN	ultrasonic nebulizer	VG	ventro gluteal
UT	urinary tract	VH	visual hallucinations
UTA	unable to assess	VI	volume index
UTD	up to date	VIP	vasoactive inhibitory polypeptide
UTI	urinary tract infection	VL	vastus lateralis
UV	ureterovesical	VM	visual memory
UVA tongs	University of Virginia tongs	VMA	vanillylmandelic acid
UVC	umbilical venous line	VO	verbal order
UVJ	ureterovesical junction	Voc	vocational
UVPP	uvulopalatopharyngoplasty	VOR	vestibular ocular reflex
v	venous	VORR	vestibular ocular reflex with rapid head thrust
v tach	ventricular tachycardia	VP	ventricular pressure
V/E	vaginal exam	V-pacing	ventricular pacing
V2 through V6	chest leads 2 through 6	VPUS	vaginal probe ultrasound
VA	visual acuity	VQ	ventilation perfusion lung scale
VAD	ventricular assist device	VR	ventricular rate of response
vag	vaginal	VRA	visual reinforcement audiometry
VATS	video assisted thoroscopic surgery	VRE	vancomycin resistant enterococcus
VB	vaginal bleeding	VS	vital signs
VBAC	vaginal birth after C-section	VSD	ventricular septal defect
VBI	vertebral basilar insufficiency	VSM	visual sequential memory
VC	vital capacity	VSR	visual spatial relations
VCG	vectorcardiogram	VSS	vital signs stable
VCUG	voiding cystourethrogram	VSV	ventricular stroke volume
vd	voided	VSX	ventricular stroke work
VDH	valvular heart disease	w/d	warm and dry
VE	vaginal examination	w/p	whirlpool
Ve	minute ventilation	W->D	wet to dry
VEF	ventricular ejection fraction	WA	while awake
vent	ventilator	WAB	Western Aphasia Battery
ventric	ventriculostomy		
VEP	visual evoked potential		
vert	vertebrae		
VF	field of vision		

WAIS-R	Wechsler Adult Intelligence Scale -Revised	WISC-R	Wechsler Intelligence Test for Children-Revised
WAP	wandering atrial pacemaker	WJ-R	Woodcock Johnson Psycho-Educational Battery-Revised
WB	weight bearing	WMS-R	Wechsler Memory Scale-Revised
WBAT	weight bearing as tolerated	WNL	within normal limits
WBC	white blood count	WRAT	Wide Range Achievement Test
WBQC	wide based quad cane	WRIOT	Wide Range Interest Opinion Test
WBTT	weight bearing to tolerance	wt	weight
WC	wheel chair	$\bar{x}$	except
WCST	Wisconsin Card Sort Test	y	yes
WD	well developed	y/n	yes/no
WDWN	well developed well nourished	y/o	year old
WFL	within functional limits		

Appendix 2 Acid–Base Balance

Metabolic acidosis

Causes: Toxic ingestions, severe diarrhea, renal failure, or excessive production of acids

Compensatory mechanism: Hyperventilation

Diagnostic tests: Low arterial pH and low serum bicarbonate

Treatment: Treat the cause of acidosis; administer bicarbonate if the acidosis is severe

Respiratory acidosis

Causes: Decreased ventilation

Compensatory mechanisms: Retention of bicarbonate, excretion of metabolic acids, increased ammonia formation

Diagnostic tests: Low arterial pH, elevated arterial pCO₂

Treatment: Treat the cause of acidosis, improve ventilation

Metabolic alkalosis

Causes: Vomiting, gastric suctioning, diuretics, severe hypokalemia, Cushing's syndrome

Compensatory mechanisms: Excretion of bicarbonate, hypoventilation

Diagnostic tests: Elevated arterial pH, elevated serum bicarbonate

Treatment: Treat the cause of alkalosis; administer NaCl or KCl, depending on etiology

Respiratory alkalosis

Cause: Hyperventilation

Compensatory mechanism: Excretion of bicarbonate

Diagnostic tests: Elevated arterial pH, low arterial pCO₂

Treatment: Treat the cause of alkalosis, CO₂ rebreathing, sedation, IV calcium gluconate if tetany develops, careful administration of KCl

Appendix 3 Allergy: Common Examples of Pseudoallergic Drug Reactions

Drug	Clinical reaction(s)	Presumed mechanism
Aspirin and other NSAIDs	Exacerbations of rhinitis, asthma (in patients with aspirin-exacerbated respiratory disease) Urticaria/angioedema (NOTE: urticaria may also result from a Type I, IgE-mediated allergic reaction)	Inhibited prostaglandin production and enhanced leukotriene production
Opiates	Pruritus, urticaria	Direct stimulation of mast cells and/or basophils causing release of mediators
Vancomycin	Flushing during infusion	Direct stimulation of mast cells and/or basophils causing release of mediators
Radiocontrast media	Anaphylaxis, shock (NOTE: some may be Type I, IgE-mediated allergic reactions)	Unknown mechanism
Ciprofloxacin	Urticaria (most reactions)	Direct stimulation of mast cells and/or basophils causing release of mediators
Local anesthetics	Syncope	Vaso-vagal reflex

Drug	Clinical reaction(s)	Presumed mechanism
Protamine	Hypotension, pulmonary hypertension	Unknown mechanism
Choline	Pruritus, urticaria	Unknown mechanism
Isoniazid	Hepatitis	Unknown mechanism

NSAIDs: Nonsteroidal anti-inflammatory drugs.

Modified from: Celik G, Pichler WJ, Adkinson NF Jr. Drug Allergy. Middleton's Allergy Principles and Practice, 7th Ed. Adkinson NF, et al. (Eds). Mosby Elsevier, Philadelphia. p. 1205–1226. 2009.

Appendix 4 Biopsy

Types of biopsy

- Excisional removal of a lesion with a margin of normal tissue. This procedure is used when the size of the lesion permits.
- Incisional or diagnostic biopsy: Removal of a representative section of the lesion.

Procedure

- Make sure all materials (e.g., fixative) are available before starting.
- The surface to be biopsied should not be painted with antiseptic or anesthetic.
- Assure appropriate medical/surgical assessment and management prior to biopsying obviously vascular lesions or lesions in patients with bleeding disorders.
- When using infiltration anesthesia, anesthetic solution should not be injected into the field from which the specimen will be taken. Rather, infiltrate around the periphery of the lesion to avoid distortion of the specimen.
- Use a sharp scalpel or punch to avoid tearing the tissue. Electrocautery should be avoided because it can cause thermal changes.
- The specimen should be handled carefully to avoid damage to the specimen.
- The tissue should be fixed immediately in 10% formalin to prevent autolysis, distortion, and destruction of the tissue. Immunofluorescence studies (e.g., vesiculobullous disease) require special preservatives (e.g., Michel's solution) instead of formalin.
- When doing incisional biopsy of a larger heterogeneous lesion, include samples of every area that demonstrates a different clinical appearance or characteristic.
- The representative areas of the lesion should be sampled.

- If a biopsy report is inconsistent with the clinical appearance of a lesion and with the history obtained, another biopsy should be performed. Two or more biopsies might be needed for a definitive diagnosis.

Biopsy request patient information

- Date of biopsy and your name, address, and phone number.
- Patient's name, address, and history (case notes) number.
- Age, sex, and race of patient.
- Clinical history and location of the lesion.

Reporting

- Tell the patient the biopsy results as soon as possible.
- Malignant findings should be disclosed in person by the appropriate clinician.

Appendix 5 Cincinnati Prehospital Stroke Scale (CPSS)

The CPSS evaluates for facial palsy, arm weakness, and speech abnormalities. Items are scored as either normal or abnormal.

Facial Droop

(The patient shows teeth or smiles)

Normal: Both sides of face move equally.

Abnormal: One side of face does not move as well as the other.

Arm Drift

(The patient closes their eyes and extends both arms straight out for 10 seconds)

Normal: Both arms move the same, or both arms do not move at all.

Abnormal: One arm either does not move, or one arm drifts down compared to the other.

Speech

(The patient repeats "The sky is blue in Cincinnati")

Normal: The patient says correct words with no slurring of words.

Abnormal: The patient slurs words, says the wrong words, or is unable to speak.

Reprinted from: Kothari RU, Pancioli A, Liu T, Brott T, Broderick J. *Annals of Emergency Medicine*, Vol. 34, Cincinnati Prehospital Stroke Scale: Reproducibility and Validity, 373-378, 1999, with permission from Elsevier.

Appendix 6 Classifications

Table A6-1 ASA Physical Status Classification System*

ASA Physical Status I	Healthy patient
ASA Physical Status II	Patient with mild systemic disease (e.g. well-controlled diabetic, asymptomatic tobacco smoker, asymptomatic aortic stenosis, asthma)
ASA Physical Status III	Patient with severe but not incapacitating or stable systemic disease (e.g. patient with severe type 2 adult-onset diabetes but requiring insulin for glycemic control, patient with significantly limited exercise tolerance due to cardiac or pulmonary disease)
ASA Physical Status IV	Patient with incapacitating systemic disease that is a constant threat to life (e.g. immediately following myocardial infarction)
ASA Physical Status V	Moribund patient, not expected to survive beyond 24 h
ASA Physical Status VI	Organ donor

*These definitions appear in each annual edition of the ASA Relavite Value Guide.

Table A6-2 Immunologic Reactions (Gell and Coombs)

Type	Description	Mechanism	Clinical features
I Immediate reaction (within 1 hour)	IgE-mediated, immediate-type hypersensitivity	Antigen exposure causes IgE-mediated activation of mast cells and basophils, with release of vasoactive substances such as histamine, prostaglandins, and leukotrienes	Anaphylaxis Angioedema Bronchospasm Urticaria (hives)

(Continued)

Table A6-2 (Continued)

Type	Description	Mechanism	Clinical features
II	Antibody dependent cytotoxicity	An antigen or hapten that is intimately associated with a cell binds to antibody, leading to cell or tissue injury	Hemolytic anemia Thrombocytopenia Neutropenia
III	Immune complex disease	Damage is caused by formation or deposition of antigen-antibody complexes in vessels or tissue. Deposition of immune complexes causes complement activation and/or recruitment of neutrophils by interaction of immune complexes with Fc IgG receptors	Serum sickness
IV	Cell-mediated or delayed hypersensitivity	Antigen exposure activates T cells, which then mediate tissue injury. Depending upon the type of T cell activation and the other effector cells recruited, different subtypes can be differentiated (i.e., Types IVa–IVd)	Contact dermatitis, some morbilliform reactions, severe exfoliative dermatoses (e.g., SJS/TEN), AGEP, DRESS/DiHS, interstitial nephritis, drug-induced hepatitis, other presentations

SJS/TEN: Stevens-Johnson syndrome/toxic epidermal necrolysis.

AGEP: Acute generalized exanthematous pustulosis.

DRESS/DiHS: Drug rash with eosinophilia and systemic symptoms/drug-induced hypersensitivity syndrome.

Adapted from: Weiss ME, Adkinson NF. Immediate Hypersensitivity Reactions to Penicillin and Related Antibiotics. *Clin Allergy* 18:515. 1988.

Table A6-3 New York Heart Association Functional Classification System

Class	Patient Symptoms
Class 1 (Mild)	No limitation of physical activity Ordinary physical activity does not cause undue fatigue, palpitation, or dyspnea (shortness of breath)
Class 2 (Mild)	Slight limitation of physical activity Comfortable at rest, but ordinary physical activity results in fatigue, palpitation, or dyspnea
Class 3 (Moderate)	Marked limitation of physical activity Comfortable at rest, but less than ordinary physical activity results in fatigue, palpitation, or dyspnea
Class 4 (Severe)	Unable to carry out any physical activity without any discomfort Symptoms of cardiac insufficiency at rest. If any physical activity is undertaken, discomfort is increased.

The Criteria Committee of the New York Heart Association. *Nomenclature and Criteria for Diagnosis of Diseases of the Heart and Great Vessels*. 9th Ed. Little, Brown and Co. Boston. 253–256. 1994.

Table A6-4 Classification and Management of Blood Pressure for Adults Aged 18 Years or Older

BP classification	Systolic BP mmHg*	Diastolic BP mmHg*	Management*	
			Lifestyle modification	Initial drug therapy
				Without compelling indication
				With compelling indications
Normal			Encourage	
Prehypertension	<120 120–139	and or 80–89	Yes	No antihypertensive drug indicated Drug(s) for the compelling indications†
Stage 1 hypertension	140–159	or 90–99	Yes	Thiazide-type diuretics for most; may consider ACE inhibitor, ARB, beta blocker, CCB, or combination Drug(s) for the compelling indications; other antihypertensive drugs (diuretics, ACE inhibitor, ARB, beta blocker, CCB) as needed
Stage 2 hypertension	≥160	or ≥100	Yes	2-drug combination for most (usually thiazide-type diuretic and ACE inhibitor or ARB or beta blocker or CCB)‡

ACE: angiotensin-converting enzyme; ARB: angiotensin-receptor blocker; BP: blood pressure; CCB: calcium channel blocker.

*Treatment determined by highest BP category.

†Treat patients with chronic kidney disease or diabetes to BP goal of less than 130/80 mmHg. Other compelling indications include disorders such as heart failure, post-myocardial infarction, and atrial fibrillation in which particular antihypertensive drugs are warranted independent of BP.

‡Initial combined therapy should be used cautiously in those at risk for orthostatic hypotension.

Adapted from: The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure, JAMA 289:2560. 2003.

Table A6-5 Sjögren's Syndrome: Proposed International Classification Criteria

The classification of Sjögren's Syndrome, which applies to individuals with signs/symptoms that may be suggestive of Sjögren's Syndrome, will be met in patients who have at least 2 of the following 3 objective features.

1. Positive serum anti-SSA/Ro and/or anti-SSB/La or (positive rheumatoid factor and ANA titer $\geq 1:320$)
2. Labial salivary gland biopsy exhibiting focal lymphocytic sialadenitis with a focus score ≥ 1 focus/4 mm²
3. Keratoconjunctivitis sicca with ocular staining score ≥ 3 (assuming that individual is not currently using daily eye drops for glaucoma and has not had corneal surgery or cosmetic eyelid surgery in the last 5 years)

Prior diagnosis of any of the following conditions would exclude participation in Sjögren's Syndrome studies or therapeutic trials because of overlapping clinical features or interference with criteria tests:

- History of head and neck radiation treatment
- Hepatitis C infection
- Acquired immunodeficiency syndrome
- Sarcoidosis
- Amyloidosis
- Graft versus host disease
- IgG4-related disease

*We excluded participants with rheumatoid arthritis, systemic lupus erythematosus, scleroderma, or other connective tissue disease from these analyses since there were only 86 (6%) such participants; ANA = antinuclear antibody

Reproduced with permission from: Shiboski SC et al. American College of Rheumatology Classification Criteria for Sjögren's Syndrome: A Data-Driven, Expert Consensus Approach in the Sjögren's International Collaborative Clinical Alliance Cohort. *Arthritis Care and Research* Vol 64(4), pp 475–487. 2012.

Appendix 7 Coagulation and Hemostasis

Table A7-1 Coagulation Cascade

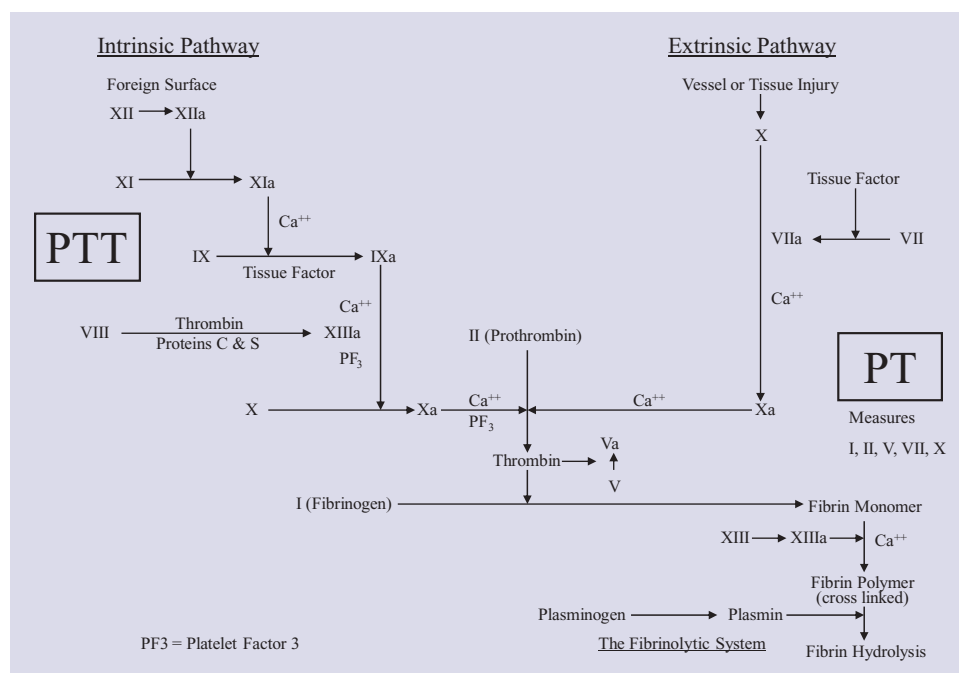


Table A7-2 Hemostasis

Bleeding disorder	Bleeding time	Platelet count	INR	PT	APTT	TT
Thrombocytopenia	+	–	0	0	0	0
Bernard Soulier Syndrome	+	– –	0	0	0	0
Glanzmann's thrombasthenia	+	0	0	0	0	0
von Willebrand's	0/+	0	0	0	0/+	0
Factor VIII, IX deficiency	0	0	0	0	+	0
Vitamin K deficiency and warfarin	0	0	+	+	0/+	0
Chronic liver disease	0/+	0/–	0/+	+	+	0/+

0: normal
 +: increased
 –: decreased

Table A7-3 Procedures to Ensure Hemostasis

Vasoconstrictors: Infiltration of vasoconstrictor will decrease bleeding from small vessels.

Position: Tilting the head upward will decrease accumulation of blood in the face.

Modified hypotensive anesthesia: Controlled reduction of blood pressure can reduce blood loss, create a better operating field, and reduce operating time. Indicated for procedures that might result in large amounts of blood loss, when the surgical field might be obscured by hemorrhage, and/or there is a high risk of postoperative hematoma. The blood pressure is carefully lowered to a systolic pressure of 85 to 90 mmHg with inhalation agents, IV medications, or a combination of these. Urine output should be measured intraoperatively, via a Foley catheter, to ensure adequate renal perfusion.

Electrocautery: Electrical current can be used to seal small blood vessels. Advise the anesthesiologist first. The electrocautery unit can be used to incise and coagulate at the same time as well as to coagulate individual vessels. Contraindicated in patients with cardiac pacemakers.

Direct ligation: Suture material might be necessary for bleeding from larger vessels. The vessel should be clamped with two hemostats with tips pointing toward one another, the vessel divided and the ends ligated.

Chemical cautery: Limited nasal or oral mucosal bleeding can often be satisfactorily treated by application of chemical agents such as silver nitrate.

Direct pressure: Until other, more definitive, measures can be taken, pressure applied directly over a bleeding vessel will usually stop the hemorrhage. In some instances, when the vessel cannot be controlled, gauze packing can be placed.

Occlusion: Bleeding from alveolar bone can be controlled by crushing nutrient canals or applying bone wax.

Hemostatic agents: Oxidized cellulose (Surgicel®)

Appendix 8 Conversion Tables

Table A8-1 Centigrade to Fahrenheit

Centigrade	Fahrenheit
41	105.6
40	104
39.5	103
38.8	102
38.3	101
37.7	100
37.2	99
37	98.6
36	96.8

Table A8-2 Kilograms to Pounds

Kg	Lb	Kg	Lb	Kg	Lb
40	88	74	162.8	108	237.6
41	90	75	165.0	109	239.8
42	92	76	167.2	110	242.0
43	95	77	169.4	111	244.2
44	97	78	171.6	112	246.4
45	99	79	173.8	113	248.6
46	101	80	176.0	114	250.8
47	103	81	178.2	115	253.0
48	106	82	180.4	116	255.2
49	108	83	182.6	117	257.4
50	110	84	184.8	118	259.6
51	112.2	85	187.0	119	261.8
52	114.4	86	189.2	120	264.0
53	116.6	87	191.4	121	266.2
54	118.8	88	193.6	122	268.4
55	121.0	89	195.8	123	270.6
56	123.2	90	198.0	124	272.8
57	125.4	91	200.2	125	275.0
58	127.6	92	202.4	126	277.2
59	129.8	93	204.6	127	279.4
60	132.0	94	206.8	128	281.6
61	134.2	95	209.0	129	283.8
62	136.4	96	211.2	130	286.0
63	138.6	97	213.4	131	288.2
64	140.8	98	215.6	132	290.4
65	143.0	99	217.8	133	292.6
66	145.2	100	220.0	134	294.8
67	147.4	101	222.2	135	297.0
68	149.6	102	224.4	136	299.2
69	151.8	103	226.6	137	301.4
70	154.0	104	228.8	138	303.6
71	156.2	105	231.0	139	305.8
72	158.4	106	233.2	140	308.0
73	160.6	107	235.4		

Table A8-3 Metric Equivalents**Weight**

1 kilogram (kg)	=1,000 grams (103 g) = 2.2 pounds (lb)
1 gram (g)	=1,000 milligrams (103 mg)
1 milligram (mg)	=1,000 micrograms (103 mcg or 10mEq)
60 milligrams (mg)	=1 grain (Gr)

Volume

1 liter (L)	=1,000 cubic centimeters (cc) of water =1,000 milliliters (ml)
-------------	---

Liquid

30 mL	=1 fluid ounce (oz) = 28.35 grams (g)
240 mL	=8 fluid ounces (oz)
480 mL	=1 pint (pt)
960 mL	=1 quart (qt)

Linear

1 millimeter (mm)	= 0.04 inch (in)
1 centimeter (cm)	= 0.4 inch (in)
2.54 centimeters	= 1 inch (in)
1 meter (m)	= 39.37 inches (in)

Table A8-4 Corticosteroids—Systemic Equivalents

Agent	Equivalent anti-inflammatory dose (mg)
Cortisone	25
Hydrocortisone (A-hydroCort®, Solu-Cortef®)	20
Prednisolone (AK-Pred®, Prelone®)	5
Prednisone (Deltasone®, Orasone®)	5
Methylprednisolone (Medrol®, Depo-Medrol®, A-methaPred®, Solu-Medrol®)	4
Triamcinolone (Aristocort®, Aristospan®, Kenacort®)	4
Dexamethasone (Decadron®, Hexadrol®, Dexasone®)	0.75
Betamethasone (Celestone®)	0.6

Appendix 9 Cranial Nerves

I	Smell: Test by asking the patient to identify common odors (e.g., coffee, peppermint, wintergreen) with the eyes closed and one nostril occluded. This is not usually done on gross examination.
II	Vision: The patient's vision can be compared at distance with the examiner's visual fields.
III	Test that the pupils are equal, round, and reactive to light and accommodation (PERRLA).
IV and VI	Test by asking the patient to move the eyes up, down, and laterally.
V	Sensory: Superficial touch (light/soft, sharp, and two-point discrimination) at the forehead, malar and mandibular areas, corneal reflex. The motor function of V can be determined by symmetry and the tension of the masseter muscles when the patient clenches the teeth.
VII	Strength and mobility in the upper and lower face can be tested by the patient wrinkling the forehead, closing the eyes tightly, and smiling.
VIII	Ears: Auditory acuity can be tested using a watch tick for a stimulus.
IX and X	Test the "gag reflex." The sensory arm is conveyed by the IXth cranial nerve and the motor response by the Xth. Determine the mobility of the soft palate by asking the patient to say "Aahhhh." Hoarseness and difficulty swallowing should be noted.
XI	The sternocleidomastoid and trapezius muscles should be observed and palpated for weakness or atrophy. Shoulder shrug.
XII	Tongue: Bilateral muscle strength and coordination, symmetry of muscle mass, range of motion (ROM), and hypertonia of the tongue should be observed. The tongue, when protruded, should not deviate from midline.

Appendix 10 Decimal Factors: Prefixes

Prefix	Symbol	Factor
mega	M	10^6
kilo	k	10^3
hecto	h	10^2
deca	da	10^1
deci	d	10^{-1}
centi	c	10^{-2}
milli	m	10^{-3}
micro	mu	10^{-6}
nano	n	10^{-9}
pico	p	10^{-12}
femto	f	10^{-15}

Appendix 11 Diets

Selection of the appropriate diet is important in many disease states, and is essential in others. This is especially true for the postsurgical and/or posttrauma patient in whom increased caloric and protein intake is required for healing. These requirements range between a 50% and 100% increase for both caloric and protein intake to minimize what would mimic Kwashiorkor and Marasmus wasting. The type of diet is especially important to the dentist in hospital practice, where extractions and other oral surgery, jaw fractures, and potentially “wired jaws,” as well as the head and neck oncologic patient with facial reconstruction and the effects of chemotherapy and radiation, mandate modification of the composition of the diet. A dietician can be consulted to design a diet for specific needs. The goal for any patient is to progress to a normal diet as rapidly as tolerated.

Liquid Diet

Clear liquid: Provides only sugar, salt, and fluid, and is inadequate in calories, protein, vitamins, and minerals. It includes such foods as broth, tea, coffee, carbonated beverages, and strained fruit juices. This diet tends to be used immediately postsurgery, while recovering from anesthesia, until bowel activity has returned.

Full liquid: Requires normal gastrointestinal function, although it requires no chewing. It is inadequate in calories, protein, thiamine, niacin, iron, and phosphorus, unless a nutritional supplement, as outlined below, is included. It includes items such as milk, ice cream, eggnog, creamed cereal, gelatin, and strained creamed soups.

Low-residue commercial diets: Commercial diets (Ensure®, Sustacal®, Meritene®, Boost®) are expensive but valuable for patients who require a long-term, low-residue diet. The amount of protein, carbohydrate, and fats vary by product. Each eight-ounce can or bottle usually contains 200 to 250 calories, and anywhere from 15% to 100% of the daily requirement for all protein, fat, carbohydrates, minerals, and vitamins. Thus, seven to 10 cans per day are required for maintenance.

Vitamins: Vitamin supplements are essential for any patient on a long-term liquid diet, if not supplemented by a commercial supplement.

Supplement feedings: Between-meal supplemental feedings are helpful for long-term patients.

Puree diet: The puree diet resembles the composition of a mechanical soft diet (below) in protein, carbohydrates, fat, minerals, and vitamins. It is processed more extensively, creating a puree consistency. It is a transitional diet between full liquid and mechanical soft.

Mechanical Soft Diet

The mechanical soft diet contains common foods that are ground. This diet consists of low-residue foods and is adequate in carbohydrates, fat, proteins, vitamins, and calories. It often serves as the transition between full liquid to regular diets, containing such easily digested proteins and carbohydrates as ground meats, eggs, cottage cheese, bananas, cooked fruits, apple sauce, and white breads and crackers (biscuits), as well as those foods in the full liquid and puree diets.

Regular Diet

The regular diet permits all foods except those that are exceptionally difficult to digest such as deep-fried foods.

Special Diets

Special diets require special orders:

- Diabetes mellitus: Caloric intake should be approximated in kcal/kg. It is denoted as “# cal. ADA diet.”
- Chronic renal failure: Generally, a diet of 0.05 to 0.75 g/kg high-quality protein with 3 to 5 g salt is acceptable.
- Congestive heart failure: Salt restriction is important in management. A patient can generally be managed successfully on a diet containing 2 g salt, although a palatable low-salt diet (2.5 g salt, 1 g sodium) can be obtained successfully only in the hospital setting; the average diet contains 6 to 15 g salt. If the addition of salt at the table is restricted, this value can be reduced to 4 to 7 g; if additional cooking salt is also limited this can be reduced to 3 to 4 g.

Total Parenteral Nutrition (TPN)

Total parenteral nutrition is provided intravenously or via a percutaneous gastric tube. It is used when the patient is neurologically obtunded, or with esophageal or other gastrointestinal deformity. It contains all of the calories, protein, minerals, vitamins, and other nutritional constituents necessary to provide maintenance and survival.

Appendix 12 Drugs and Medications

Table A12-1 Asthma Medications

Medication	Use	Action	Caution
Methylxanthines Aminophylline Theophylline	Oral	Bronchodilation	Avoid epinephrine, erythromycin
Beta-2 receptor agonists Isoetharine (orciprenaline sulphate) Metaproterenol Isoproterenol Albuterol (Ventolin®)	Inhaled	Bronchodilation	Avoid epinephrine
Corticosteroids	Systemic inhalant	Decreased inflammation	Systemic: Hyperglycemia Inhaled: Not for acute attacks
Mast cell inhibitors Cromolyn sodium	Inhaled	Decreased mast cell mediator release	Not for acute attacks

Table A12-2 Bisphosphonates

Generic name	Brand name	Manufacturer	Oral (PO) versus intravenous (IV)	Nitrogen-containing
Alendronate sodium	Fosamax®	Merck	PO (tabs or oral solution)	Y
Alendronate sodium	Binosto™	EffRx Pharmaceuticals	PO (tabs)	Y
Alendronate sodium vit D ₃	Fosamax plus D®	Merck	PO (tabs)	Y
Ibandronate sodium	Boniva®	Roche	PO (tabs) IV	Y
Etidronate disodium	Didronel®	Procter and Gamble	PO (tabs)	N
Tiludronate disodium	Skelid®	Sanofi-Synthelabo	PO (tabs)	N
Risedronate sodium	Actonel®	Procter and Gamble	PO (tabs)	Y
Risedronate sodium + calcium	Actonel® with calcium	Procter and Gamble	PO (tabs)	Y
Risedronate sodium	Atelvia®	Warner Chilcott Laboratories	PO (tabs)	Y
Pamidronate sodium	Aredia®	Novartis	IV	Y
Zoledronic acid	Zometa®	Novartis	IV	Y
Zoledronic acid	Reclast®	Novartis	IV	Y
Zoledronic acid	Aclasta®	Novartis	IV	Y

Table A12-3 Chemotherapy Drugs Associated with Mucositis

Category	Specific drugs
Alkylating agents	Busulfan
	Carboplatin
	Cisplatin
	Cyclophosphamide
	Ifosfamide
	Mechlorethamine
	Melphalan
	Procarbazine
Anthracyclines	Thiotepa
	Daunorubicin
	Doxorubicin
	Idarubicin
	Epirubicin
	Mitoxantrone
Antimetabolites	Capecitabine
	Cytarabine
	Fluorouracil
	Fludarabine
	Gemcitabine
	Hydroxyurea
	Methotrexate
	6-Mercaptopurine
	Pemetrexed
	Pralatrexate
Antitumor antibiotics	6-Thioguanine
	Dactinomycin
	Bleomycin
	Mitomycin
Taxanes	Docetaxel
	Paclitaxel
Topoisomerase inhibitors	Etoposide
	Topotecan
	Irinotecan
	Teniposide

Table A12-4 Common Medications Used in Dental Practice

Category	Medication ¹	Available Forms ²	Adult Dosage ³	Pediatric Dosage ⁴
Non-Narcotic Analgesics	Acetaminophen (OTC)	Tablets/capsules 80 mg, 325 mg, 500 mg, 650 mg ER; suppositories 120 mg, 325 mg, 650 mg ER; suspensions 80 mg/0.8 ml, 160 mg/5 ml)	325 to 650 mg PO q 4 to 6 h, Max: 4 g/day* *FDA recommends 33 g/day	For children <12 years: 10 to 15 mg/kg/dose PO q 4 to 6 h, Max: 5 doses (50 to 75 mg/kg/day)
	Aspirin/ASA (OTC/Rx)	For analgesic indication: tablets 325 mg, 500 mg	325 to 500 mg PO q 4 to 6 h, Max: 4 g/day	Not recommended for children <16 years due to an association with Reye's syndrome, unless specifically indicated.
	Ibuprofen (OTC/Rx)	For analgesic indication: tablets/capsules 100 mg, 200 mg (OTC), 400 mg (Rx); suspensions 50 mg/1.25 ml, 100 mg/5 ml	Analgesia/pain/fever Analgesic dose: 200 to 400 mg PO q 6 to 8 h, Max: 2.4 g/day	For children <12 years: Analgesia/pain/fever: 4 to 10 mg/kg/dose PO q 6 to 8 h, Max: 40 mg/kg/day Children ≥12 years: 200 mg PO q 4 to 6 h, Max: 1200 mg/day
	Naproxen sodium (OTC/Rx)	Tablets/capsules 220 mg (OTC), 250 mg, 375 mg, 500 mg, 500 mg DR, 550 mg (Rx)	220 to 500 mg PO q 12 h, Max: 11 g /day Adults >65 years: 200 mg PO q 12 h	Use in children between 2 and 12 years only recommended for juvenile arthritis: 2.5 to 5 mg/kg/dose PO q 12 h
	Ketorolac	60 mg for intramuscular or intravenous injection	Adults <65 years: Single dose: 60 mg IM or 30 mg IV/IM	Safety and effectiveness of ketorolac in pediatric patients <16 years have not been established For children ≥16 years and >50 kg: Adult dose

Combination Analgesics	Acetaminophen with hydrocodone	Tablets/capsules 325 mg, 500 mg, 650 mg, 750 mg acetaminophen with 5 mg, 7.5 mg, 10 mg hydrocodone; elixir 500 mg/15 ml acetaminophen; 5 mg or 7.5 mg/15 ml hydrocodone	One or two tablets PO q 4 to 6 h Maximum daily dose limited by maximum daily dose of 4 g acetaminophen	Safety and effectiveness in the pediatric population have not been established
	Acetaminophen with codeine	Tablets/capsules 300 mg, acetaminophen with 15 mg, 30 mg, 60 mg codeine, liquid/elixir/solution or suspension 120 mg/5 ml acetaminophen; 12 mg/5 ml codeine	One or two tablets PO q 4 to 6 h Maximum daily dose limited by maximum daily dose of 4 g acetaminophen, although some clinicians recommend a maximum daily dose of 360 mg codeine	For children <12 years: 0.5 to 1 mg codeine/kg/dose PO q 4 to 6 h, 10 to 15 mg acetaminophen/kg/dose PO q 4 to 6 h, Max: 2.6 g acetaminophen/day
	Acetaminophen with oxycodone	Tablets/capsules 325 mg, 500 mg, 650 mg acetaminophen with 2.5 mg, 5 mg, 7.5 mg, or 10 mg oxycodone, solution 325 mg/5 ml acetaminophen; 5 mg/5 ml oxycodone	One or two tablets PO q 4 to 6 h, Maximum daily dose limited by maximum daily dose of 44 g acetaminophen Not to exceed 5 tablets in 24 hours	Safety and effectiveness in pediatric patients have not been established
	Acetaminophen with tramadol	Tablets 325 mg acetaminophen, 37.5 mg tramadol	Two tablets PO q 4 to 6 h Max: 2600 mg acetaminophen, 300 mg tramadol/day	Safety and effectiveness has not been studied in the pediatric population
	Ibuprofen with hydrocodone	Tablets 200 mg ibuprofen with 5 mg or 7.5 mg hydrocodone	One or two tablets PO q 4 to 6 h Max: 5 tablets/day	Safety and effectiveness of hydrocodone/ibuprofen in pediatric patients <16 years have not been established

(Continued)

Table A12-4 (Continued)

Category	Medication ¹	Available Forms ²	Adult Dosage ³	Pediatric Dosage ⁴
Narcotic Analgesics	Tramadol	Tablets 50 mg, 100 mg ER, 200 mg ER, 300 mg ER	50 to 100 mg PO q 4 to 6 h or 100 to 300 mg ER PO q 24 h/day Max: 400 mg or 300 mg ER/day	Safety and effectiveness of tramadol in pediatric patients <16 years have not been established
	Oxycodone	Tablets 5 mg, 10 mg, 15 mg, 30 mg or 10 mg, 20 mg, 30 mg, 40 mg, 60 mg, 80 mg ER Tablets/capsules 10 to 200 mg ER	One or two tablets PO q 4 to 6 h or one tablet ER PO bid q 12 h One tablet ER PO bid q 12 h	Safety and effectiveness of oxycodone in pediatric patients <18 years have not been established Safety and effectiveness in pediatric patients have not been established
	Morphine			
Topical Anesthetics, Anti-Inflammatories, Neutralizing, And Saline Rinses¹	Lidocaine	Ointment (2.5 or 5%), viscous solution/jelly (2%)	Ointment: Rub sparingly and gently on affected areas q 4 to 6 h Max: 4.5 mg/kg, not to exceed 300 mg Viscous solution: Rinse with 5 to 10 ml and expectorate, no more frequently than q 3 h Max: 8 doses/60 ml or 1200 mg lidocaine/day	Ointment/Solution: For children ≥ years: Adult dose Viscous solution: For infants and children <3 years or those who cannot expectorate: 1.25 ml, dose should be accurately measured and applied to the affected area with a cotton-tipped tip applicator no more frequently than q 3 h max. Max: 4 doses q 12 h/day For children ≥3 years and those who can expectorate: Swished in the mouth and spit out no more frequently q 3 h, Solution: Only recommended for children who can gargle and expectorate excess. Max dose: 4.5 mg/kg/dose; or 300 mg/dose 4 doses/day

¹When topical anesthetics are used, patients should be cautioned about a reduced gag reflex and caution while eating and drinking to avoid possible airway compromise.

Diphenhydramine (OTC)	Multiple dosage forms: 1. Diphenhydramine elixir 12.5 mg/5 ml 2. Mix 4 oz. Diphenhydramine elixir (12.5 mg/5 ml) and 4 oz. Kaopectate® or aluminum hydroxide/magnesium hydroxide (Maalox®) in 1:1 ratio 3. Mix 4 oz. Diphenhydramine elixir (12.5 mg/5 ml) and 4 oz. Kaopectate® or Maalox® and viscous lidocaine 2% in 1:1:1 ratio	Rinse with 1 teaspoon q 2 h and expectorate	
Benzylamine hydrochloride (Not available in the U.S.) Diffiam®	Oral rinse (0.15%), spray (0.15%), lozenge (3 mg)	Oral rinse: Rinse with 15 ml for 30 sec and expectorate q 1.5 to 3 h Spray: 4 to 8 sprays onto affected area q 1.5–3 h Lozenge: 1 q 1 to 2 h, PR, max: 12/day Uninterrupted treatment should not exceed 7 days	Oral Rinse: Not suitable for children <6 years or those that cannot expectorate, Children ≥6 years: Rinse with 5 to 15 ml for 30 sec and expectorate q 1.5 to 3 h Spray: For children <6 years: 1 spray/4 kg body weight; Max: 4 sprays, q 1.5 to 3 h Children between 6 and 12 years: 4 sprays q 1.5 to 3 h Lozenge: Not recommended for children <6 years Uninterrupted treatment should not exceed 7 days
Neutral rinse	Mix 1/2 teaspoon of salt and 2 tablespoons of sodium bicarbonate in 32 oz. of water	Swish and spit with copious amounts q 4 to 6 h	
Saline rinse	1/2 teaspoon of salt in 8 oz. of water	Swish as needed	

(Continued)

Table A12-4 (Continued)

Category	Medication ¹	Available Forms ²	Adult Dosage ³	Pediatric Dosage ⁴
Anti-Inflammatory: Nonsteroidal Anti-Inflammatory Agents	Ibuprofen (OTC/Rx)	For anti-inflammatory indication: Tablets/capsules 200 mg (OTC), 400 mg, 600 mg, 800 mg (Rx)	Anti-inflammatory dose 400 to 800 mg PO q 6 to 8 h Max: 2400 mg/day	
	Diflunisal	Tablets (250 mg, 500 mg)	250 to 500 mg PO bid	
	Celecoxib Celebrex®	Capsules (50 mg, 100 mg, 200 mg, 400 mg)	100 to 200 mg PO bid	
Corticosteroids (Topical)*	Triamcinolone acetoneide	Cream, ointment (0.025%, 0.1%, 0.5%), or in a dental paste 0.1% (Dermatology rated as mild to intermediate potency)	Use creams extra-orally, ointment or dental paste intra-orally Apply a thin layer to affected area 2 to 4 times/day.	Short-term use in children (5–7 days maximum)
	Betamethasone	Cream, ointment (0.05%, 0.1%) (Dermatology rated as intermediate potency)	Use creams extra-orally, ointment intra-orally Apply a thin layer to affected area 1 to 2 times/day	Administration to children should be limited to the least amount compatible with an effective therapeutic regimen
	Fluocinonide	Cream ointment/gel (0.025%, 0.05%) (Dermatology rated as potent)	Apply a thin layer to affected area 1 to 2 times/day for 1 to 2 weeks	Administration to children should be limited to the least amount compatible with an effective therapeutic regimen
	Clobetasol	Cream/ointment/gel 0.05% (Dermatology rated as ultra-potent)	Apply a thin layer to affected area 1 to 2 times/day, 1 to 2 weeks maximum	Safety and effectiveness in pediatric patients have not been established and is not recommended for patients <12 years
	Dexamethasone	Dexamethasone elixir/solution: 0.5 mg/5 ml (Dermatology rated as potent)	Swish 5 to 15 ml for up to 3 min and expectorate q 4 to 8 h, for 1 to 2 weeks	Use only in older children who can rinse: Swish with 5 ml for 2 to 3 minutes and expectorate q 6 to 8 h, for 1 to 2 weeks.

***Note: Topical creams are easily washed away by saliva and are generally reserved for extra-oral use**

Injectable Corticosteroids	Triamcinolone acetanide Kenalog®	10 mg/ml and 40 mg/ml suspension	Up to 1 ml per injection site (intralesional). Initial dose per injection site will vary depending on the specific disease entity and lesion being treated	Administration to children should be limited to the least amount compatible with an effective therapeutic regimen
	Betamethasone (Celestone® Soluspan®)	6 mg/ml suspension	Up to 1 ml per injection site (intralesional). Initial dose per injection site will vary depending on the specific disease entity and lesion being treated	
Systemic Corticosteroids:	Prednisone	Tablets (1 mg, 2 mg, 5 mg, 10 mg, 20 mg)	Multiple dose regimens depending on underlying condition, 0.5 to 1 mg/kg/day PO. Long-term use (>7 days) requires tapering regimen to discontinue and close monitoring for adverse effects related to chronic corticosteroid use	Administration to children should be limited to the least amount compatible with an effective therapeutic regimen
Immunomodulatory Agents	Azathioprine	Tablets (50 mg, 75 mg, 100 mg)	50 to 100 mg PO bid Pre-screening of patients warranted for ability to metabolize azathioprine Close monitoring for hepatotoxicity and bone marrow suppression	(Continued)
	Mycophenolate mofetil	Tablets, capsules (180 mg ER, 250 mg, 360 mg ER, 500 mg)	250 to 1500 mg PO bid Close monitoring for bone marrow suppression	

Table A12-4 (Continued)

Category	Medication ¹	Available Forms ²	Adult Dosage ³	Pediatric Dosage ⁴
Antihistamines	Dapsone	Tablets (25 mg, 100 mg)	Initial dose: 25 PO mg daily, to titrate slowly by 25 mg/week to a max of 300 mg/day Pre-screening of patients warranted for G6PD Close monitoring for hemolytic anemia and hepatotoxicity	
	Colchicine	Available as 0.6 mg tablets	1 tablet PO up to tid	
	Topical calcineurin inhibitors:	Ointment (0.03%, 0.1%)	Apply ointment thinly to affected area bid or tid	
	Diphenhydramine (OTC)	Tablets/capsules (25 mg, 50 mg), or for IM/IV or intra-oral local anesthetic injection (10 or 50 mg/ml solution)	25 to 50 mg PO q 6h, Max: 300 mg/day (PO), or 400 mg/day (IM/IV) For intraoral local anesthetic injection: Use 10 mg/ml solution, Maximum dose 1.5 ml/injection per patient	For children >12 kg: 5 mg/kg/day PO/IM/IV in divided doses q 6 to 8 h, Max: 300 mg/day
Antiemetics	Ondansetron	Tablets (4 mg, 8 mg, 24 mg), solution (4 mg/5 ml), or IV (2 mg/ml)	Prevention of nausea and vomiting due to chemotherapy: 8 mg q8 to 12h OR Single 32 mg IV dose over 15 minutes OR 0.15 mg/kg/dose IV over 15 minutes q 8h Prevention of postoperative nausea and vomiting: 16 mg given 1 hour before induction of anesthesia OR 4 mg IV over 2 to 5 minutes or IM	Prevention of nausea and vomiting due to chemotherapy: 0.15 mg/kg IV over 15 minutes q 8h, OR, For children between 4 and 11 years: 4 mg PO q 8h, For children ≥12 years: Adult dose Prevention of postoperative nausea and vomiting: For children between 1 month and 12 years: single 0.1 mg/kg dose, For children >12 years or >40 kg: Adult dose

Anti-Infectives Antibiotics Systemic Topical Rinses	Prochlorperazine	Tablets (5 mg, 10 mg), suppositories (25 mg) or for IM/ IV injection (5 mg/ml)	5 to 10 mg PO q 8 h, OR 5 to 10 mg IM/IV (rate not to exceed 5 mg/minute for IV) q 6 h, Max: 40 mg/day	Only recommended for children >2 years or >20 pounds in weight; For children between 20 and 29 lbs.: 2.5 mg PO/PR q 12 to 24 h, Max: 7.5 mg/day; For children between 30 and 39 lbs.: 2.5 mg PO/PR, q 8 to 12 h, Max: 10 mg/ day; For children between 40 and 85 lbs.: 2.5 mg PO/PR q 8 h or 5 mg PO/ PR q 12 h, Max: 15 mg/day For children >2 years: 0.5 mg/pound of body weight PO/IM/PR q 4 to 6 h
	Promethazine	Tablets (12.5 mg, 25 mg, 50 mg), suppositories (12.5 mg, 25 mg, 50 mg), syrup 12.5 mg/5 ml, solution 6.25 mg/5 ml, or for IM use	12.5 to 25 mg PO/IM/PR q 4 to 6 h	
	Trimethoprim	Capsules (100, 250, 300 mg), suppositories (200 mg), or for IM	250 mg PO q 6 to 8 h, or 200 mg IM/PR	For children <30 lbs.: 100 mg PO/PR q 6 to 8 h; For children between 30 and 90 lbs.: 100 to 200 mg PO/PR q 6 to 8 h
	Penicillin V potassium	Tablets (250 mg, 500 mg) or solution (125 mg/5 ml, 250 mg/5 ml)	125 to 500 mg, PO q 6 h	Children <12 years: 25 to 50 mg/kg/day PO in divided doses q 6 to 8 h, Max: 3 g/day
	Penicillin G potassium	Available for IM/IV injection	2 to 24 million units/day (depending on the severity of infection) in divided doses IV q 4 h	100,000 to 400,000 units/kg/day (depending on the severity of infection) IV in divided doses q 4 to 6 h
	Amoxicillin	Tablets/capsules (125 mg, 200 mg, 250 mg, 400 mg, 500 mg, 875 mg), or suspension 125 mg/5 ml, 200 mg/5 ml, 250 mg/5 ml, 500 mg/5 ml)	500 mg PO q 8 h For infective endocarditis prophylaxis: 2 g PO 1 h before procedure	Children >3 months up to 40 kg: 20 to 50 mg/kg/day PO in divided doses q 8 to 12 h For infective endocarditis prophylaxis: 50 mg/kg PO 1 h before procedure (Continued)

Table A12-4 (Continued)

Category	Medication ¹	Available Forms ²	Adult Dosage ³	Pediatric Dosage ⁴
	Amoxicillin/ clavulanate	Tablets (200 mg, 250 mg, 400 mg, 500 mg, 875 mg, 1000 mg ER), or suspension (125 mg/5 ml, 250 mg/5 ml, 500 mg/5 ml, 600 mg/5 ml)	500 mg PO q 8 h	Children >3 months and up to 40 kg: 25 to 45 mg/kg/day PO in divided doses q 12 h
	Azithromycin	Tablets (250 mg, 500 mg, 600 mg) or suspension (100 mg/5 ml, 200 mg/5 ml)	500 mg once/day for 3 days For infective endocarditis prophylaxis: 500 mg PO 1 h before procedure	For children >6 months: 10 mg/kg once/day for 3 days For infective endocarditis prophylaxis: 15 mg/kg PO 1 h before procedure
	Clindamycin	Capsules (75 mg, 150 mg, 300 mg), or as a solution (75 mg/5 ml)	150 to 450 mg PO q 6 h OR 1.2 to 1.8 g/day IV in divided doses q 6 to 12 h For infective endocarditis prophylaxis: 600 mg PO 1 h before procedure, if IV, 30 minutes before procedure	10 to 25 mg/kg/day PO in divided doses q 6 to 8 h OR Children >1 month: 20 to 40 mg/kg/day IV in divided doses q 6 to 8 h For infective endocarditis prophylaxis: 20 mg/kg PO 1 h before procedure, if IV 30 minutes before procedure
	Cephalexin	Capsules (250 mg, 500 mg, 750 mg), or as suspension (125 mg/5 ml, 250 mg/5 ml)	250 to 500 mg PO q 6 h, Max: 4 g/day For infective endocarditis prophylaxis: 2 g PO 1 h before procedure	25 to 50 mg/kg/day PO in divided doses q 6 h For infective endocarditis prophylaxis: 50 mg/kg PO 1 h before procedure
	Cephazolin	IM/IV injection	500 to 1000 mg IV/IM q 6 to 8 h For infective endocarditis prophylaxis: 1 g IM/IV 30 min before procedure	Child >1 month: 25 to 50 mg/kg/day IV/IM q 6 to 8 h For infective endocarditis prophylaxis: 25 mg/kg IV/IM 30 min before procedure

Erythromycin	Stearate, estolate or ethylsuccinate: tablets/capsules (250 mg, 333 mg, 400 mg, 500 mg, 500 mg ER)	250 to 500mg PO q 6 h, if twice-a-day or thrice-a-day dosage is desired, one-half or one-third of the total daily dose may be given q 8h or q12h respectively For severe infections in both adults and children: 15 to 20 mg/kg/day IV in divided doses q 6 h	30 to 50mg/kg/day PO in divided doses q 6 h, Max: 2 g/day
	Glucopate or lactobionate		
Metronidazole	Tablets/capsules (250mg, 375 mg, 500 mg, 750 mg ER)	250 to 750mg PO q 8 h OR 7.5 mg/kg IV q 8 h	For children >1 month: 7.5 mg/kg PO/IV q 8 h; Max: 4 g/day
Tetracycline	Capsules (250 mg, 500mg)	250 to 500mg PO q 6h; 1 h before or 2 h after meals	Not recommended for children <8 years Children ≥8 years: 25 to 50mg/kg/day PO in divided doses q 6 h; 1 h before or 2 h after meals
Doxycycline	Tablets/capsules (20mg, 40mg MR, 50 mg, 75 mg, 100 mg, 100 mg ER 150mg), suspension (25 mg/5 ml) or syrup (50 mg/5 ml), or as Atridox® (50 mg preparation for subgingival application)	100 mg od (or 50mg bid) for periodontal disease (short term) 20mg bid for periodontal disease (long term)	
Chlorhexidine oral rinse	0.12% formulated with and without alcohol	Swish with 15 ml for 30 seconds and expectorate q 12 h	Not recommended for children who cannot gargle

(Continued)

Table A12-4 (Continued)

Category	Medication ¹	Available Forms ²	Adult Dosage ³	Pediatric Dosage ⁴
Antifungals Topical	Clotrimazole	Troches (10mg), or cream (1%, 2%)	1 troche to dissolve in mouth 5 times/day for 10 to 14 days Apply cream to affected area up to three times/day	
	Nystatin	Suspension (100,000 units/ml), pastilles (200,000 units/pastille), tablets (500,000 units/tablet), vaginal tablet (100,000 units/tablet), cream (100,000 units/g), ointment (100,000 units/g), or powder (100,000units/g)	Oral suspension: Swish 400,000 to 600,000 units for 2 minutes and swallow q 6h, for at least 48 hours after symptoms have disappeared. Pastilles, vaginal tablets: Dissolve 1 to 2 intra-orally 4 to 5 times/day for 2 weeks Cream, ointment, powder: Apply to affected area q 6 to 8h	Oral suspension: Children >3 months: swish 250,000to 500,000 units for 2 minutes and swallow q 6h Newborn: 100,000 units q 6h Cream, ointment, powder: Apply to affected area q 6 to 8h
	Miconazole	Cream (2%, 4%), or as a mucoadhesive tablet (50 mg) Oravig TM	Apply to affected lesions q 6 to 8h for 5 to 7 days Oravig TM : apply tablet od for 14 days	Precaution with use of cream in children <2 years Oravig TM not approved for children
Systemic	Fluconazole ⁵	Tablets (50mg, 100mg, 150mg, 200mg) and suspension (10 mg/ml, 40mg/ml)	200mg PO on first day, then 100mg/day for 10 to 14 days	Children >1 month: 3 to 6mg/kg PO on first day, then 3 mg/kg/day
Antivirals Topical	Acyclovir cream	5% cream	Apply to affected areas q 4h for 5 to 10 days, starting at first sign of herpes labialis	
	Penciclovir cream Denavir®	1% cream	Apply to affected area q 2 h starting at first sign of herpes labialis	Safety and effectiveness in pediatric patients <12 years of age have not been established
	Docosanol cream (OTC) Abreva®	10% cream	Apply to affected area q 3 to 4h, starting at first sign of attack until healed	Not approved for use by children younger than 12 years old

Systemic	Acyclovir	Tablets (200 mg, 400 mg, 800 mg)	200 to 800 mg PO q 4 h for 5 to 7 days	Children ≥ 2 years: 20 mg/kg/dose, q 6 h for 5 days
	Valacyclovir	Tablets (500 mg, 1 g)	Herpes simplex infection: Abortive therapy: 2 g bid starting at first sign of herpes labialis Suppressive therapy: 500 mg to 1 g PO once/day OR 500 mg PO bid in immunocompromised patients Treatment of active infection in immunocompromised patients: 500 to 1000 mg PO q 12 h for 5 days	
	Famciclovir	Tablets (125 mg, 250 mg, 500 mg)	Herpes zoster infection: 500 mg PO q 8 h for 7 days Herpes simplex infection: Abortive therapy: 1500 g as a single dose starting at first sign of herpes labialis Suppressive therapy: 250 mg PO bid OR 500 mg PO bid in immunocompromised patients Treatment of active infection in immunocompromised patients: 500 mg PO bid for 7 days	

(Continued)

Table A12-4 (Continued)

Category	Medication ¹	Available Forms ²	Adult Dosage ³	Pediatric Dosage ⁴
Muscle Relaxants	Cyclobenzaprine	Tablets (5 mg, 7.5 mg, 10 mg, 15 mg)	5 to 10 mg PO q 8 h for 1 to 2 weeks	Safety and effectiveness in children <15 years have not been established
	Diazepam	Tablets (2 mg, 5 mg, 10 mg)	Adjunctively for relief of skeletal muscle spasm: 2 to 10 mg PO q 6 to 8 h	Adjunctively for relief of skeletal muscle spasm in adults
	Metaxalone	Tablets (800 mg)	800 mg PO q 6 to 8 h	
Anti-Anxiolytic Agents	Diazepam	Tablets (2 mg, 5 mg, 10 mg), or IV	For preprocedural sedation and anxiolysis: 5 mg PO on night before minor or dental surgery then 5 mg 2 h before procedure For elderly: Half the adult dose	For preprocedural sedation and anxiolysis: 0.2 to 0.5 mg/kg 1 to 2 h before procedure
	Lorazepam	Tablets (0.5 mg, 1 mg, 2 mg)	For preprocedural sedation and anxiolysis: 2 to 3 mg PO night before minor or dental surgery then 2 to 4 mg 1 to 2 h before procedure	
	Hydroxyzine	Tablets/capsules (10 mg, 25 mg, 50 mg, 100 mg), syrup (10 mg/5 ml), injection (25 mg/ml)	For preprocedural sedation and anxiolysis: 50 to 100 mg PO	For preprocedural sedation and anxiolysis: 0.6 mg/kg PO 1 h before procedure

Orofacial Pain	Amitriptyline	Tablets (10 mg, 25 mg, 50 mg)	10 or 25 mg PO at bedtime for 7 days then titrate up to 75 mg/day as needed (higher doses under specialist supervision)
	Nortriptyline	Tablets (10 mg, 25 mg, 50 mg)	10 or 25 mg PO at bedtime for 7 days then titrate to 75 mg/day as needed (higher doses under specialist supervision)
	Gabapentin	Tablets/capsules (100 mg, 300 mg, 400 mg, 600 mg, 800 mg)	Neuropathic pain: Increase dose over time beginning with 100 mg tid Usual dose: 300–1200 mg PO tid Max dose: 3600 mg/day
	Pregabalin	Capsules (25 mg, 50 mg, 100 mg, 200 mg, 225 mg, 300 mg)	Neuropathic pain: Increase dose over time beginning with 50 mg tid Max of 600 mg/day
	Carbamazepine	Tablets/capsules (100 mg, 200 mg, 400 mg)	Trigeminal neuralgia: Initial dose: 100 mg PO q 12 to 24 h, increase dose slowly according to response 100 to 200 mg every 2 weeks. Usual dose: 200 mg q 6 to 8 h, Max: 1.2 g/day

(Continued)

Table A12-4 (Continued)

Category	Medication ¹	Available Forms ²	Adult Dosage ³	Pediatric Dosage ⁴
Topical	Capsaicin	Cream: 0.025 to 0.075% Zostrix®	Apply a small amount on affected area q 6 to 8 h	
	Clonazepam	Tablets (0.125 mg, 0.5 mg, 1 mg)	Burning neuropathy (burning mouth syndrome): 1. Topical: Suck on a 1-mg tablet for 3 min at area of burning 1–3 times/day then spit. 2. Systemic: 0.25 mg PO at bedtime for 1 week, then dose escalation to 0.75 mg/day as needed Taste changes: Dissolve 0.25 to 0.50 mg tablet on tongue at bedtime	
Salivary Stimulants	Pilocarpine (Rx)	Tablets (5 mg, 7.5 mg)	5 to 10 mg PO up to 3 times/day Max: 30 mg/day in divided doses	
	Cevimeline (Rx) Evxac®	Capsules (30 mg)	30 mg PO tid	

Diphenhydramine (OTC)	Multiple dosage forms: 1. Diphenhydramine elixir 12.5 mg/5 ml 2. Mix 4 oz. Diphenhydramine elixir (12.5 mg/5 ml) and 4 oz. Kaopectate® or aluminum hydroxide/magnesium hydroxide (Maalox®) in 1:1 ratio 3. Mix 4 oz. Diphenhydramine elixir (12.5 mg/5 ml) and 4 oz. Kaopectate® or Maalox® and viscous lidocaine 2% in 1:1 ratio	Rinse with 1 teaspoon q 2 h and expectorate	
Benzydamine hydrochloride Not available in the USA) Diffiam™	Oral rinse (0.15%), spray (0.15%), lozenge (3 mg)	Oral rinse: Rinse with 15 ml for 30 sec and expectorate q 1.5 to 3 h Spray: 4 to 8 sprays onto affected area q 1.5 to 3 h Lozenge: 1 q 1 to 2 h, PR, max: 12/day Uninterrupted treatment should not exceed 7 days	Oral rinse: Not suitable for children <6 years or those that cannot expectorate. Children ≥6 years: Rinse with 5 to 15 ml for 30 sec and expectorate q 1.5 to 3 h Spray: For children <6 years: 1 spray/4 kg body weight; Max: 4 sprays, q 1.5 to 3 h Children between 6 and 12 years: 4 sprays q 1.5 to 3 h Lozenge: not recommended for children <6 years Uninterrupted treatment should not exceed 7 days
Neutral rinse	Mix 1/2 teaspoon of salt and 2 tablespoons of sodium bicarbonate in 32 oz. of water	Swish and spit with copious amounts q 4 to 6 h	
Saline rinse	1/2 teaspoon of salt in 8 oz. of water	Swish as needed	

(Continued)

Table A12-4 (Continued)

Category	Medication ¹	Available Forms ²	Adult Dosage ³	Pediatric Dosage ⁴
Anti-Inflammatory: Nonsteroidal Anti-Inflammatory Agents	Ibuprofen (OTC/Rx)	For anti-inflammatory indication: tablets/capsules 200 mg (OTC), 400 mg, 600 mg, 800 mg (Rx)	Inflammatory disease: 400 to 800 mg PO q 6 to 8 h, Max: 3.2 g/day	Use in children between 6 months and 12 years, recommended for juvenile idiopathic arthritis: 30–50 mg/kg/day in divided doses q 8 h, Max: 2.4 g/day
	Diflunisal	Tablets (250 mg, 500 mg)	250 to 500 mg PO q 12 h	Safety and effectiveness in pediatric patients <12 years have not been established.
Corticosteroids (Topical)*	Celecoxib Celebrex®	Capsules (50 mg, 100 mg, 200 mg, 400 mg)	100 to 200 mg PO q 12 h	Use in children between 2 and 12 years, only recommended for juvenile rheumatoid arthritis: For patients ≥10 kg and ≤25 kg, 50 mg PO q 12 h; for patients >25 kg, 100 mg PO q 12 h
	Triamcinolone acetonide	Cream, ointment (0.025%, 0.1%, 0.5%), or in a dental paste 0.1% (Dermatology rated as mild to intermediate potency)	Use creams extra-orally, ointment or dental paste intra-orally Apply a thin layer to affected area 2 to 4 times/day	Apply a thin layer to affected area 2 to 3 times/day. Short-term use in children, Max: 5 to 7 days
	Betamethasone	Cream, ointment (0.05%, 0.1%) (Dermatology rated as intermediate potency)	Use creams extra-orally, ointment intra-orally Apply a thin layer to affected area 1 to 2 times/day	Apply a thin layer to affected area 1 to 2 times/day Administration to children should be limited to the least amount compatible with an effective therapeutic regimen

*Note: Topical creams are easily washed away by saliva and are generally reserved for extra-oral use

Injectable Corticosteroids	Fluocinonide	Cream ointment/gel (0.025%, 0.05%) (Dermatology rated as potent)	Apply a thin layer to affected area 1 to 2 times/day for 1 to 2 weeks	Apply a thin layer to affected area 1 to 2 times/day for 1 to 2 weeks Administration to children should be limited to the least amount compatible with an effective therapeutic regimen
	Clobetasol	Cream/ointment/gel 0.05% (Dermatology rated as ultra-potent)	Apply a thin layer to affected area 1 to 2 times/day, Max: 1 to 2 weeks	Safety and effectiveness in pediatric patients have not been established and is not recommended for patients <12 years
	Dexamethasone	Dexamethasone elixir/solution: 0.5 mg/5 ml (Dermatology rated as potent)	Swish 5 to 15 ml for up to 3 min and expectorate q 4 to 8 h, for 1 to 2 weeks	Use only in older children (>12 years) who can rinse: Swish with 5 ml for 2 to 3 minutes and expectorate q 6 to 8 h, for 1 to 2 weeks
	Triamcinolone acetonide Kenalog®	10 mg/ml and 40 mg/ml suspension	Up to 1 ml/injection site (intralesional). Initial dose/injection site will vary depending on the specific disease entity and lesion being treated	Administration to children should be limited to the least amount compatible with an effective therapeutic regimen
	Betamethasone (Celestone® Soluspan®)	6 mg/ml suspension	Up to 1 ml/injection site (intralesional). Initial dose/injection site will vary depending on the specific disease entity and lesion being treated	Administration to children should be limited to the least amount compatible with an effective therapeutic regimen

(Continued)

Table A12-4 (Continued)

Category	Medication ¹	Available Forms ²	Adult Dosage ³	Pediatric Dosage ⁴
Systemic Corticosteroids:	Prednisone	Tablets (1 mg, 2 mg, 5 mg, 10 mg, 20 mg)	Multiple dose regimens depending on underlying condition, 0.5 to 1 mg/kg/day PO. Long term use (>7days) requires tapering regimen to discontinue and close monitoring for adverse effects related to chronic corticosteroid use	Anti-inflammatory dose: 0.05 to 2 mg/kg/day divided in 1 to 4 doses Administration to children should be limited to the least amount compatible with an effective therapeutic regimen
	Azathioprine	Tablets (50 mg, 75 mg, 100 mg)	50 to 100 mg PO q 12 h Prescreening of patients warranted for ability to metabolize azathioprine Close monitoring for hepatotoxicity and bone marrow suppression	Safety and efficacy of azathioprine in pediatric patients have not been established
Immunomodulatory Agents	Mycophenolate mofetil	Tablets, capsules (180 mg ER, 250 mg, 360 mg ER, 500 mg)	250 to 1500 mg PO q 12 h Close monitoring for bone marrow suppression	Safety and efficacy of mycophenolate mofetil in pediatric patients have not been established for use other than for organ rejection post solid organ transplantation
	Dapsone	Tablets (25 mg, 100 mg)	Initial dose: 25 PO mg daily, to titrate slowly by 25 mg/week, Max: 300 mg/day Pre-screening of patients warranted for G6PD Close monitoring for hemolytic anemia and hepatotoxicity	Safety and efficacy of dapsone in pediatric patients have not been established for use other than pneumocystis prophylaxis and toxoplasma gondii

	Colchicine	Available as 0.6 mg tablets	1 tablet PO up to q 8h	Safety and effectiveness of colchicine in pediatric patients has not been established
Topical calcineurin inhibitors:	Tacrolimus Protopic®	Ointment (0.03%, 0.1%)	Apply ointment thinly to affected area q 12h	Not indicated for children <2 years For children aged 2 to 15 years: Only the 0.03% formulation is recommended
Antihistamines	Diphenhydramine (OTC)	Tablets/capsules (25 mg, 50 mg), or for IM/IV or intra-oral local anesthetic injection (10 or 50 mg/ml solution)	For moderate to severe allergic reaction: 25 to 50 mg PO/IM/IV q 4 to 6h Max: 400 mg/day For intraoral local anesthetic injection: Use 10 mg/ml solution, Maximum dose 1.5 ml/injection/patient	For moderate to severe allergic reactions: 5 mg/kg/day PO/IM/IV in divided doses q 6 to 8h, Max: 300 mg/day
Antiemetics	Ondansetron	Tablets (4 mg, 8 mg, 24 mg), solution (4 mg/5 ml), or IV (2 mg/ml)	Prevention of nausea and vomiting due to chemotherapy: 8 mg PO q 8h OR 24 mg PO q 24h OR Single 32 mg IV dose over 15 minutes OR 0.15 mg/kg/dose IV over 15 minutes q 8h Prevention of postoperative nausea and vomiting: 16 mg given 1 hour before induction of anesthesia OR 4 mg IV over 2 to 5 minutes/IM	Prevention of nausea and vomiting due to chemotherapy: 0.15 mg/kg IV over 15 minutes q 8h, OR, For children between 4 and 11 years: 4 mg PO q 8h, For children ≥12 years: Adult dose Prevention of postoperative nausea and vomiting: For children between 1 month and 12 years: single 0.1 mg/kg dose, For children >12 years or >40kg: Adult dose

(Continued)

Table A12-4 (Continued)

Category	Medication ¹	Available Forms ²	Adult Dosage ³	Pediatric Dosage ⁴
Anti-Infectives Antibiotics Systemic Topical Rinses	Prochlorperazine	Tablets (5 mg, 10 mg), suppositories (25 mg) or for IM/IV injection (5 mg/ml)	5 to 10 mg PO q 8 h, OR 5 to 10 mg IM/IV (rate not to exceed 5 mg/minute for IV) q 6 h, Max: 40 mg/day	Only recommended for children >2 years or >9 kg: 0.4 mg/kg/day PO/PR in divided doses q 6 to 8 h OR for children between 10 and 14 kg: 2.5 mg PO/PR q 12 to 24 h, Max: 7.5 mg/day; For children between 15 and 18 kg: 2.5 mg PO/PR, q 8 to 12 h, Max: 10 mg/day; For children between 19 to 39 kg: 2.5 mg PO/PR q 8 h or 5 mg PO/PR q 12 h, Max: 15 mg/day
	Promethazine	Tablets (12.5 mg, 25 mg, 50 mg), suppositories (12.5 mg, 25 mg, 50 mg), syrup 12.5 mg/5 ml, solution 6.25 mg/5 ml, or for IM use	12.5 to 25 mg PO/IM/PR q 4 to 6 h	For children ≥2 years: 0.25 to 1 mg/kg (not to exceed 25 mg) PO/IM/PR q 6 h Use with extreme caution using the lowest, most effective dose in children
	Trimethobenzamide	Capsules (100, 250, 300 mg), suppositories (200 mg), or for IM	250 mg PO q 6 to 8 h, or 200 mg IM/PR q 6 to 8 h	For children: 15 to 20 mg/kg/day in divided doses q 6 to 8 h OR For children <13.6 kg: 100 mg PO/PR q 6 to 8 h; For children between 13.6 to 40 kg: 100 to 200 mg PO/PR q 6 to 8 h
	Penicillin V potassium	Tablets (250 mg, 500 mg), or solution (125 mg/5 ml, 250 mg/5 ml)	250 to 500 mg PO q 6 h	Children <12 years: 25 to 50 mg/kg/day PO in divided doses q 6 to 8 h, Max: 3 g/day
	Penicillin G potassium	Available for IM/IV injection	2 to 24 million units/day (depending on the severity of infection) IV in divided doses q 4 h	100,000 to 400,000 units/kg/day (depending on the severity of infection) IV in divided doses q 4 to 6 h, Max: 24 million units/day

Amoxicillin	Tablets/capsules (125 mg, 200 mg, 250 mg, 400 mg, 500 mg, 875 mg), or suspension (125 mg/5 ml, 200 mg/5 ml, 250 mg/5 ml, 500 mg/5 ml)	500 mg PO q 8 h For infective endocarditis prophylaxis: 2 g PO 1 h before procedure	Children >3 months and up to 40 kg: 20 to 50 mg/kg/day PO in divided doses q 8 to 12 h For infective endocarditis prophylaxis: 50 mg/kg PO 1 h before procedure
Amoxicillin/clavulanate	Tablets (200 mg, 250 mg, 400 mg, 500 mg, 875 mg, 1000 mg ER), or suspension (125 mg/5 ml, 250 mg/5 ml, 500 mg/5 ml, 600 mg/5 ml)	500 mg PO q 8 h	Children ≥3 months and up to 40 kg: 25 to 45 mg (amoxicillin component)/kg/day PO in divided doses q 12 h
Azithromycin	Tablets (250 mg, 500 mg, 600 mg) or suspension (100 mg/5 ml, 200 mg/5 ml)	500 mg once/day for 3 days For infective endocarditis prophylaxis: 500 mg PO 1 h before procedure	For children ≥6 months: 10 mg/kg once/day for 3 days Max: 500 mg/day For infective endocarditis prophylaxis: 15 mg/kg PO 1 h before procedure
Clindamycin	Capsules (75 mg, 150 mg, 300 mg), or as a solution (75 mg/5 ml)	150 to 450 mg PO q 6 h, Max: 1.8 g/day OR 1.2 to 2.7 g/day IV/IM in divided doses q 6 to 12 h, Max: 4.8 g/day For infective endocarditis prophylaxis: 600 mg PO 1 h before procedure, if IV, 30 minutes before procedure	10 to 40 mg/kg/day PO in divided doses q 6 to 8 h, Max: 1.8 g/day OR Children >1 year: 20 to 40 mg/kg/day IV/IM in divided doses q 6 to 8 h For infective endocarditis prophylaxis: 20 mg/kg PO 1 h before procedure, if IV 30 minutes before procedure
Cephalexin	Capsules (250 mg, 500 mg, 750 mg), or as suspension (125 mg/5 ml, 250 mg/5 ml)	250 to 500 mg PO q 6 h, Max: 4 g/day For infective endocarditis prophylaxis: 2 g PO 1 h before procedure	25 to 50 mg/kg/day PO in divided doses q 6 to 8 h, Max dose: 4 g/day For infective endocarditis prophylaxis: 50 mg/kg PO 1 h before procedure

(Continued)

Table A12-4 (Continued)

Category	Medication ¹	Available Forms ²	Adult Dosage ³	Pediatric Dosage ⁴
	Cephazolin	IM/IV injection	500 to 1000 mg IV/IM q 6 to 8 h, Max: 12 g/day For infective endocarditis prophylaxis: 1 g IV/IM 30 min before procedure	Child > 1 month: 25 to 50 mg/kg/day IV/IM q 6 to 8 h, Max: 6 g/day For infective endocarditis prophylaxis: 50 mg/kg IV/IM 30 min before procedure
	Erythromycin	Stearate, estolate, or ethylsuccinate: tablets/capsules (250 mg, 333 mg, 400 mg, 500 mg, 500 mg ER)	250 to 500 mg PO q 6 h, if twice-a-day or thrice-a-day dosage is desired, one-half or one-third of the total daily dose may be given q 8 h or q 12 h respectively	30 to 50 mg/kg/day PO in divided doses q 6 to 8 h, Max: 2 g (base or stearate)/day or 3.2 g (ethylsuccinate)/day
		Glucopate or lactobionate	For severe infections in both adults and children: 15 to 20 mg/kg/day IV in divided doses q 6 h, Max: 4 g/day	
	Metronidazole	Tablets/capsules (250 mg, 375 mg, 500 mg, 750 mg ER)	250 to 750 mg PO q 8 h OR 7.5 mg/kg IV q 8 h	15 to 35 mg/kg/day PO in divided doses q 8 h OR 30 mg/kg/day IV in divided doses q 6 h
	Tetracycline	Capsules (250 mg, 500 mg)	250 to 500 mg PO q 6 h; 1 h before or 2 h after meals	Not recommended for children <8 years For children ≥8 years: 25 to 50 mg/kg/day PO in divided doses q 6 h; 1 h before or 2 h after meals, Max: 3 g/day
	Doxycycline	Tablets/capsules (20 mg, 40 mg MR, 50 mg, 75 mg, 100 mg, 100 mg ER 150 mg), suspension (25 mg/5 ml) or syrup (50 mg/5 ml), or as Atridox® (50 mg preparation for subgingival application)	100 mg PO q 24 h OR 50 mg PO q 12 h for periodontal disease (short term) 20 mg q 12 h for periodontal disease (long term)	Not recommended for children <8 years For children ≥8 years and ≤45 kg: 2 to 4 mg/kg/day PO/IV in divided doses q 12 to 24 h, Max: 200 mg/day

Antifungals Topical	Chlorhexidine oral rinse	0.12% formulated with and without alcohol	Swish with 15 ml for 30 seconds and expectorate q 12h	Not recommended for children who cannot gargle
	Clotrimazole	Troches (10 mg) or cream (1%, 2%)	1 troche to dissolve in mouth 5 times/day for 10 to 14 days Apply cream sparingly to affected area q 12h, Max: 3 doses/day	Safety and effectiveness of clotrimazole in children ≤ 3 years have not been established; therefore, its use in such patients is not recommended. For children >3 years: apply cream sparingly to affected area twice daily.
	Nystatin	Suspension (100,000 units/ml), pastilles (200,000 units/pastille), tablets (500,000 units/tablet), vaginal tablet (100,000 units/tablet), cream (100,000 units/g), ointment (100,000 units/g), or powder (100,000 units/g)	Oral suspension: Swish 400,000 to 600,000 units for 2 minutes and swallow q 6h for at least 48 hours after symptoms have disappeared. Pastilles, vaginal tablets: Dissolve 1 to 2 intraorally 4 to 5 times/day for 2 weeks Cream, ointment, powder: Apply to affected area q 6 to 12h	Oral suspension: For infants: 200,000 to 400,000 units q 6h For children >3 months: Swish 250,000 to 500,000 units for 2 minutes and swallow q 6h Cream, ointment, powder: Apply to affected area q 6 to 12h
Systemic	Miconazole	Cream (2%, 4%), or as a mucoadhesive tablet (50 mg) Oravig TM	Apply to affected lesions q 6 to 8h for 5 to 7 days Oravig TM : apply tablet od for 14 days	Precaution with use in children <2 years Oravig TM not approved for children
	Fluconazole ⁵	Tablets (50 mg, 100 mg, 150 mg, 200 mg) and suspension (10 mg/ml, 40 mg/ml)	Oropharyngeal candidiasis treatment: 200 mg PO on first day, then 100 mg/day for 10 to 14 days	For children >1 month: Oropharyngeal candidiasis treatment: 6 mg/kg PO on first day, then 3 mg/kg/day once daily for at least 14 days, Max: 200 mg/day

(Continued)

Table A12-4 (Continued)

Category	Medication ¹	Available Forms ²	Adult Dosage ³	Pediatric Dosage ⁴
Antivirals Topical	Acyclovir cream	5% cream	Apply to affected areas q 4 h starting at first sign of herpes labialis for 4 days	Safety and effectiveness in pediatric patients <12 years have not been established. For children ≥12 years: Adult dose
	Penciclovir cream Denavir®	1% cream	Apply to affected area q 2 h starting at first sign of herpes labialis for 4 days	Safety and effectiveness in pediatric patients <12 years have not been established
	Docosanol cream (OTC) Abreva®	10% cream	Apply to affected area q 3 to 4 h, starting at first sign of attack until healed	Not approved for use by children <12 years
Systemic	Acyclovir	Tablets (200 mg, 400 mg, 800 mg)	Herpes labialis: 1. Treatment: 200 to 400 mg 5 times/day for 5 days; For immunocompromised hosts: 400 mg 5 times/day for 7 to 14 days 2. Suppressive therapy: 400 mg PO q 12 h	Herpes labialis: 1. Treatment: 15 mg/kg/dose 5 times/day for 7 days, initiated within 72 hours of symptom onset, Max: 200 mg/dose; For immunocompromised host and ≥2 years: 1 g/day in 3 to 5 divided doses for 7 to 14 days, Max: 80 mg/kg/day not to exceed 1 g/day 2. Suppressive therapy: 30 mg/kg/day in divided doses q 8 h, Max: 1 g/day; For immunocompromised hosts: 600 to 1000 mg/day in 3 to 5 divided doses, Max: 80 mg/kg/day not to exceed 1 g/day
			Herpes zoster (shingles): Treatment: 500 mg 5 times/day for 7 to 10 days	Herpes zoster (shingles): Treatment: For children ≥1 year: 10 mg/kg/dose q 8 h for 7 to 10 days

Valacyclovir	Tablets (500 mg, 1 g)	Herpes labialis: Abortive therapy: 2 g q 12 h for 1 day, initiated at earliest sign Herpes zoster infection (shingles): 1 g PO q 8 h for 7 days	The efficacy and safety of valacyclovir have not been established in pediatric patients <12 years with herpes labialis and those who are <18 years with genital herpes and/or herpes zoster. In children ≥12 years: herpes labialis: adult dose
Famciclovir	Tablets (125 mg, 250 mg, 500 mg)	Herpes labialis: Abortive therapy: 1.5 g as a single dose initiated at earliest sign, For immunocompromised host: 500 mg q 12 h for 7 days Herpes zoster infection (shingles): 500 mg PO q 8 h for 7 days	The efficacy and safety of famciclovir in pediatric patients <18 years have not been established.
Muscle Relaxants			
Cyclobenzaprine	Tablets (5 mg, 7.5 mg, 10 mg, 15 mg)	5 to 10 mg PO q 8 h for 1 to 2 weeks	Safety and effectiveness in pediatric patients <15 years have not been established
Diazepam	Tablets (2 mg, 5 mg, 10 mg)	Adjunctively for relief of skeletal muscle spasm: 2 to 10 mg PO q 6 to 8 h	0.12 to 0.8 mg/kg/day PO in divided doses q 8 h; initiate therapy with lowest dose and increase as required because of varied responses to CNS-acting drugs in pediatric patients
Metaxalone	Tablets (800 mg)	800 mg PO q 6 to 8 h	Safety and effectiveness in pediatric patients <12 years have not been established For children ≥12 years: Adult dose

(Continued)

Table A12-4 (Continued)

Category	Medication ¹	Available Forms ²	Adult Dosage ³	Pediatric Dosage ⁴
Anti-Anxiolytic Agents	Diazepam	Tablets (2 mg, 5 mg, 10 mg), or IV	For preprocedural sedation and anxiolysis: 5 mg PO on night before minor or dental surgery then 5 mg 2 h before procedure For elderly: Half the adult dose	For preprocedural sedation and anxiolysis: 0.2 to 0.3 mg/kg/dose 1 h before procedure, Max: 10 mg
	Lorazepam	Tablets (0.5 mg, 1 mg, 2 mg)	For preprocedural sedation and anxiolysis: 2 to 3 mg PO night before minor or dental surgery then 2 to 4 mg 1 to 2 h before procedure	For preprocedural sedation and anxiolysis: 0.05 mg/kg/dose PO 1 to 2 h before procedure, Max: 2 mg/dose
	Hydroxyzine	Tablets/capsules (10 mg, 25 mg, 50 mg, 100 mg), syrup (10 mg/5 ml), injection (25 mg/ml)	For preprocedural sedation and anxiolysis: 50 to 100 mg PO	For preprocedural sedation and anxiolysis: 0.6 mg/kg/dose PO 1 h before procedure
	Amitriptyline	Tablets (10 mg, 25 mg, 50 mg)	10 or 25 mg PO at bedtime for 7 days then titrate up to 75 mg/day as needed (higher doses under specialist supervision)	Safety and effectiveness in pediatric patients <12 years have not been established.
Orofacial Pain	Nortriptyline	Tablets (10 mg, 25 mg, 50 mg)	10 or 25 mg PO at bedtime for 7 days then titrate to 75 mg/day as needed (higher doses under specialist supervision)	Safety and effectiveness in the pediatric population have not been established and is not recommended

Gabapentin	Tablets/capsules (100 mg, 300 mg, 400 mg, 600 mg, 800 mg)	Neuropathic pain: Initial: 100 mg q 8h; titrate to effect; doses can be increased by 300 mg/day at weekly intervals; Usual dosage range: 1800 to 2400 mg/day divided into 3 doses/day; Max: 3.6 g/day Post-herpetic neuralgia: Initial: single 300mg dose, Day 2: 300 mg q 12h, Day 3: 300mg q 8h, titrate dose as needed up to 600mg q 8h. Usual effective dose: 1800mg/day in 3 divided doses Max dose: 1.8g/day	Effectiveness in pediatric patients <3 years has not been established Neuropathic pain: Limited information is available. Initial: 5 mg/kg/dose at bedtime Day 2: Increase to 5 mg/kg/dose q 12 h Day 3: Increase to 5 mg/kg/dose q 8h; titrate to effect. Usual effective dose: 8 to 35 mg/kg/day in divided doses q 8h
Pregabalin	Capsules (25 mg, 50mg, 100mg, 200 mg, 225 mg, 300mg)	Neuropathic pain/post herpetic neuralgia: Initial: 50mg q 8h OR 75 mg q 12h, may be increased within 1 week based on tolerability and effect, Max dose: 300mg/day (neuropathic pain), 600 mg/day (post-herpetic neuralgia)	The safety and efficacy of pregabalin in pediatric patients have not been established

(Continued)

Table A12-4 (Continued)

Category	Medication ¹	Available Forms ²	Adult Dosage ³	Pediatric Dosage ⁴
Topical	Carbamazepine	Tablets/capsules (100 mg, 200 mg, 400 mg)	Trigeminal neuralgia: Initial dose: 100 mg PO q 12 to 24 h, increase dose slowly according to response 100 to 200 mg every 2 weeks. Usual dose: 400 to 800 mg q 12 h Max: 1.2 g/day	The safety and efficacy of carbamazepine in pediatric patients for treatment of trigeminal neuralgia have not been established
	Capsaicin	Cream: 0.025 to— 0.075% Zostrix®	Apply a small amount on affected area q 6 to 8 h	The safety and effectiveness in patients <18 years have not been studied
	Clonazepam	Tablets (0.125 mg, 0.5 mg, 1 mg)	Burning neuropathy (burning mouth syndrome): 1. Topical: Suck on a 1-mg tablet for 3 min at area of burning 1 to 3 times/day then spit. 2. Systemic: 0.25 mg PO at bedtime for 1 week, then dose escalation to 0.75 mg/day as needed Taste changes: Dissolve 0.25 to 0.50 mg tablet on tongue at bedtime	Safety and effectiveness in pediatric patients <18 years with burning neuropathy have not been studied
Salivary Stimulants	Pilocarpine	Tablets (5 mg, 7.5 mg)	5 to 10 mg PO up to 3 times/day, Max: 30 mg/day in divided doses	Safety and effectiveness in pediatric patients have not been established.
	Cevimeline Evoxac®	Capsules (30 mg)	30 mg PO q 8 h	Safety and effectiveness in pediatric patients have not been established

Fluoride Preparations Topical[®]	Fluoride Gels	0.4% stannous fluoride: gel 1.1% sodium fluoride: PreviDent® Brush-on Gel	Using a toothbrush, apply onto all tooth surfaces daily after tooth brushing at least for 1 minute and expectorate	Not recommended for children < 6 years or for children who cannot expectorate.
	Fluoride mouth rinses	Sodium fluoride: 0.05% to 0.2%	0.05% solution: Rinse daily with 10ml for 1 min and expectorate 0.2% solution: Rinse weekly with 10ml for 1 min and expectorate	Not recommended for children < 6 years or for children who cannot expectorate
	Fluoride toothpaste	1.1% sodium fluoride: PreviDent® 5000 Plus	Brush teeth for 1 minute before spitting out	Not recommended for children < 16 years
	Fluoride varnish	5% sodium fluoride	Apply to affected areas (i.e., areas of decalcification) as dictated by caries risk assessment	
Systemic	Sodium fluoride	Tablets (0.25 mg, 0.5 mg, 1 mg), drops (0.25 mg/drop)	Not indicated for adults	USA Fluoride Supplementation Schedule (below)

¹Unless otherwise specified, all are available generically, either prescribed or over the counter (OTC)

²ER refers to an extended, sustained, or delayed release formulation

³Assumes healthy adult. If patient is elderly, or has renal/hepatic disease, dosing may require alteration

⁴Unless otherwise specified, safety and effectiveness in the pediatric population has not been established for the indication

⁵Note: If patient fails to respond, consult infectious diseases

⁶Applicable to all: Refrain from eating, drinking, and rinsing for 30 minutes

Table A12-4 (Continued)

Dietary Fluoride Supplementation Schedule

Child's age	Fluoride concentration		
	<0.3 ppm	0.3 to 0.6 ppm	>0.6 ppm
Birth to 6 months	0.0	0.0	0.0
6 months to 3 years	0.25 mg/day	0.0	0.0
3 to 6 years	0.50 mg/day	0.25 mg/day	0.0
6 to 16 years	1.0 mg/day	0.50 mg/day	0.0

Recommended Texts:

Yagiela JA, Dowd FJ, Johnson BS, Mariotti JJ, Neidle E. Pharmacology and Therapeutics for Dentistry, 6th Ed. Mosby Elsevier, St. Louis, 2010.
 Hardman JG, Limbird LE, Gilman AG. Goodman & Gilman's The Pharmacologic Basis for Therapeutics, 10th Ed. McGraw Hill, New York, 2005.

Table A12-5 Dilutions for Parenteral Drugs

Medication	Common adult dosage	Vehicle solution	Common administration rates	Volume of vehicle solution	Expiration date upon dispensing*
Ampicillin	1 g	NS	Usually over 30 min; dose must be given over at least 15 min	50 cc	24 h
	2 g	NS		100 cc	Less stable in more concentrated solution
Ampicillin/sulbactam (Unasyn)	1.5 to 3 g	NS	Usually over 30 min; dose must be given over at least 15 min	50 to 100 cc	24 h
Cefazolin	1 g	D5W or NS	Over 30 min	50 cc	24 h
Cefoxitin	1 g	D5W or NS	Over 30 min	50 cc	24 h
Clindamycin	600 mg	D5W or NS	Usually over 60 min; 600 mg must be given over at least 20 min	100 cc	24 h
Gentamicin	60 to 80 mg	D5W or NS	Over at least 30 min	50 to 100 cc	24 h
Nafcillin	1 to 2 g	D5W or NS	Over 30 min	1 g in 50 cc	24 h
Potassium penicillin	Up to 3 million units	D5W or NS	Over 60 min	50 cc	24 h
Vancomycin	1 g	D5W or NS	Over at least 60 min	250 cc	24 h
Hydrocortisone sodium succinate (Solu-Cortef®)		Reconstitute with sterile water	Over at least 1 min		

*Maximum of 24 hour expiration recommended due to sterility concerns. Some products chemically stable longer and have longer expirations if prepared in an LAF hood in a pharmacy or in a ready-to-use form from the manufacturer.

Table A12-6 Drugs and Medications of Concern in Dental Practice

Drug	Concern
Aminophylline	Avoid erythromycin, clarithromycin
Antibiotics	Rifampin. Other antibiotics may cause reduced contraceptive effect
Antifungals	Reduced contraceptive effect with itraconazole, fluconazole
Antiplatelet agents (e.g., clopidogrel, dipyridamole/ASA, ticlopidine)	Bleeding
Aspirin*	Potential for bleeding, especially gastric. Potentiation for oral bleeding not established
Bisphosphonates	Risk for bisphosphonate-related osteonecrosis of the jaw
Calcium channel blockers (e.g., nifedipine, diltiazem)	Gingival overgrowth, hyperplasia
Warfarin	Bleeding; may be enhanced with aspirin and some NSAIDs, erythromycin, fluconazole, metronidazole, sulfamethoxazole-trimethoprim, ginkgo. Reduced anticoagulant effect with carbamazepine, nafcillin, and vitamin K
Isoproterenol	Avoid epinephrine
Lithium	Xerostomia, infection, neutropenia, renal failure, stomatitis
MAO inhibitors	Xerostomia, hypotension, tachycardia, arrhythmias
Neuroleptics	Xerostomia, hypotension, tachycardia, arrhythmias, bleeding, thrombocytopenia, infection, neutropenia
Phenytoin	Gingival overgrowth, hyperplasia
Prednisone	Consider supplementation for stressful procedures
Theophylline	Avoid erythromycin, clarithromycin
Arachidonic acid	
Endoperoxides	
↓ cyclo-oxygenase	
↓ thromboxane A ₂ → platelet aggregation and vasoconstriction	

*Antiplatelet effect due to acetylation of cyclo-oxygenase and suppression of thromboxane A₂ production. At least 95% of thromboxane is required for effective platelet function. A single dose of 100mg is required to achieve this level, which occurs 15 to 30 minutes after ingestion of standard (not controlled release) aspirin. After the last dose there is little or no recovery of thromboxane for two to three days. Aspirin has some effect in suppressing platelets released from megakaryocytes over the next several days. Thus, platelet suppression continues for more than 48 hours. A total turnover of the platelet pool takes about eight days.

Table A12-7 Drugs Used in Dental Practice with Significant Allergic Potential and Alternative Medication(s)

Medication	Substitute medication(s)
Antibiotics	
Penicillins	Clindamycin, clarithromycin, azithromycin
Analgesics	
Aspirin	Acetaminophen
Narcotics	Nonsteroidal can be substituted but allergy can occur
Local anesthetics	
Esters	
Procaine	Lidocaine
Benzocaine	Diphenhydramine
Tetracaine	
Methylparaben preservative	Alternative preservative or anesthetic without preservative

Table A12-8 Drug Interactions

Drug	Interacting Agents	Result Effect
Acetaminophen (paracetamol)	Ethanol	Increased liver toxicity
Aminoglycosides	Neuromuscular blockers	Enhanced neuromuscular blockade, respiratory suppression
Anesthetics, general	Antidepressants	Hypotension
	Antihypertensives	Hypotension
Anticholinergics (atropine)	Antihistamines	Increased anticholinergic effect
	Levodopa	Increased anticholinergic effect
	Phenothiazines	Increased anticholinergic effect
	Antidepressants, tricyclics	Increased anticholinergic effect
Antihistamines (sedating)	Alcohol	CNS depression
	Phenothiazines	Increased sedation

(Continued)

Table A12-8 (Continued)

Drug	Interacting Agents	Result Effect
Anti-inflammatory (NSAIDs)	Anticoagulant	Increased bleeding
	Ethanol	Increased gastric bleeding
	Heart failure medications	Fluid retention, CHF exacerbation
	Lithium	Increased lithium toxicity
Aspirin	Methotrexate	Methotrexate toxicity
	Acetazolamide	Increased acetazolamide
Barbiturates	Methotrexate	Methotrexate toxicity
	Alcohol	Enhanced sedation, increased respiratory depression
	Anticoagulants, oral	Decreased anticoagulant effect
	Antidepressants, tricyclics	Decreased antidepressant effect
	Beta-adrenergic blockers	Decreased beta-blocker effect
	Corticosteroids	Decreased steroid effect
	Digitalis glycosides	Decreased digitoxin effect
	Griseofulvin	Decreased griseofulvin effect
	Phenothiazines	Decreased phenothiazines effect
	Quinidine	Decreased quinidine effect
	Rifampin	Decreased barbiturate effect
	Valproic acid	Increased phenobarbital effect
Benzodiazepines (Chlordiazepoxide, diazepam, lorazepam)	Alcohol	Enhanced sedation
	Barbiturates	Enhanced sedation, increased respiratory depression
Carbamazepine	Anticoagulants (oral)	Decreased anticoagulant effect
	Cyclosporine	Decreased cyclosporine levels
	Diltiazem	Increased carbamazepine effect, possible reduced diltiazem effect
	Doxycycline	Decreased doxycycline effect
	Felodipine	Decreased felodipine effect
	Fluconazole	Increased carbamazepine effect
	Methadone	Decreased methadone level, withdrawal
	Propoxyphene	Increased carbamazepine effect
Clindamycin	Neuromuscular blockers	Enhanced neuromuscular blockade

Table A12-8 (Continued)

Drug	Interacting Agents	Result Effect
	Diphenoxylate/atropine	Use caution with use of diphenoxylate (Lomotil®) for antibiotic associated diarrhea due to concern for retaining Clostridium difficile toxin
Corticosteroids	Barbiturates	Decreased corticosteroid effect
	Insulin	Steroids may increase blood glucose
	Phenytoin	Decreased corticosteroid effect
	Rifampin	Decreased corticosteroid effect
Erythromycin	Lovastatin and most statins	Increased risk of myopathy
and clarithromycin*	Clozapine	Increased clozapine, seizure potential
	Cyclosporine/tacrolimus	Increased immune suppressant toxicity
	Digoxin	Digoxin toxicity
	Dofetilide	Increased dofetilide, arrhythmia
	Ergotamine	Ergotism, hypertension, and ischemia
	Midazolam, triazolam	Increased benzodiazepine level
	Theophylline	Increased theophylline level
Fluconazole and ketoconazole	Benzodiazepines	Increased CNS depression
	Cyclosporine, sirolimus, tacrolimus	Increased immunosuppressant
	Carbamazepine	Increased carbamazepine
	Cisapride	Increased risk arrhythmia
	Phenytoin	Increased level phenytoin
	Rifampin	Decreased antifungal
	Warfarin	Increased anticoagulant effect
Fluoride	Aluminum hydroxide (antacids)	Decreased fluoride absorption
Ketoconazole	Antacids, drugs decreasing GI acid	Decreased ketoconazole absorption
	Pimozide	Increased risk arrhythmia
	Dofetilide	Increased dofetilide, arrhythmia
	Protease inhibitors (HIV)	Increased protease inhibitor level
	Statins (most; not pravastatin)	Increased risk rhabdomyolysis
	Also see interactions listed above under fluconazole	

(Continued)

Table A12-8 (Continued)

Drug	Interacting Agents	Result Effect
Meperidine (pethidine)	Barbiturates	Increased CNS depression
	Curariform drugs	Increased respiratory depression
	Monoamine oxidase inhibitors (phenelzine)	Life threatening serotonin syndrome, hypertension
	Selegiline	Serotonin syndrome
	Serotonin antidepressants	Serotonin syndrome
Metronidazole	Sibutramine	Serotonin syndrome
	Contraceptives, oral	Reduced contraceptive effect
	Cyclosporine	Increased cyclosporine toxicity
	Warfarin	Increased anticoagulant effect
Penicillins	Methotrexate	Methotrexate toxicity
	Bacteriostatic antibiotics	Reduced penicillin efficacy
	Contraceptives	Reduced contraceptive effect
	Alcohol	Increased CNS depression
	Levodopa	Decreased levodopa effect
Phenothiazines (promethazine)	Lithium	Decreased phenothiazine effect
	Alcohol	Increased respiratory depression
	Carbamazepine	Increased carbamazepine effect
Propoxyphene	Cations, antacids, sucralate, calcium, didanosine, iron, magnesium	Decreased absorption of antibiotic
Quinolones	Anticoagulants, oral	Increased bleeding risk
	Hypoglycemics	Increased hypoglycemia
	Probenecid	Increased antibiotic level
	Antidepressants, tricyclics	Hypertension, hypertensive crisis
	Antihypertensive drugs	Decreased antihypertensive effects
Sympathomimetic amines (epinephrine, phenylephrine)	Beta-adrenergic blockers	Hypertension with epinephrine
		Lack of effect when treating anaphylaxis w/epinephrine
	Halogenated anesthetics	Cardiac arrhythmias
	Digitalis glycosides	Tendency to cardiac arrhythmias
Tetracyclines	Indomethacin	Severe hypertension
	Antacids	Decreased tetracycline absorption
	Bactericidal antibiotics	Reduced antibiotic efficacy
	Barbiturates	Decreased doxycycline effect

Table A12-8 (Continued)

Drug	Interacting Agents	Result Effect
	Bismuth subsalicylate	Decreased tetracycline effect
	Carbamazepine	Decreased doxycycline effect
	Contraceptives	Reduced contraception effect
	Iron, oral	Decreased tetracycline absorption
	Methotrexate	Methotrexate toxicity
	Methoxyflurane (thiopentone)	Increased nephrotoxicity
	Milk and dairy products	Decreased tetracycline effect
	Phenytoin	Decreased doxycycline effect
	Warfarin	Possible increased anticoagulant effect
	Zinc sulfate	Decreased tetracycline absorption

*Azithromycin has little inhibitory effect on CYP3A4 enzymes and so is less likely to be involved in these drug interactions.

Table A12-9 Drugs with Fetal Effects from Maternal Exposure

Risk factors (A, B, C, D, X) have been assigned to all drugs, based on the level of risk for teratogenicity. Risk factors are designed to help the reader quickly classify a drug for use during pregnancy. They do not refer to breastfeeding risk. The definitions for the factors are those used by the Food and Drug Administration.

Drugs with Risk Factors for Teratogenicity

Risk factor	Description
A	Controlled studies in women fail to demonstrate a risk to the fetus in the first trimester, and the possibility of fetal harm appears remote.
B	Animal studies do not indicate a risk to the fetus and there are no controlled human studies, or animal studies do not show an adverse effect on the fetus but well controlled studies in pregnant women have failed to demonstrate a risk to the fetus.
C	Studies have shown that the drug exerts animal teratogenic or embryocidal effects, but there are no controlled studies in women, or no studies are available in either animals or women.
D	Positive evidence of human fetal risk exists, but benefits in certain situations (e.g., life-threatening situations or serious disease for which safer drugs cannot be used or are ineffective) may make use of the drug acceptable despite its risks.
X	Studies in animals or humans have demonstrated fetal abnormalities, or there is evidence of fetal risk based on human experience, or both, and the risk clearly outweighs any possible benefit.

Briggs GC, Freeman RK, Yaffe SJ. Drugs in Pregnancy and Lactation, 6th Ed. Lippincott Williams and Wilkins, Philadelphia. 2002.

(Continued)

Table A12-9 (Continued)

Some Common Medications that are Considered Safe for Use During Pregnancy	
Nonsteroidal Anti-Inflammatory Drugs	Cefotaxime: B
Acetaminophen: B	Cefazolin: B
Ibuprofen: B (First or second trimester only)	Cefoxitin: B
Ketorolac: B (First or second trimester only)	Clindamycin: B
Naproxen: B	Erythromycin: B
	Penicillin: B
Narcotic Analgesics	
Codeine: B	Miscellaneous
Fentanyl: B	Methohexital: B
Meperidine: B	
Methadone B	
Morphine: B	
Antibiotics	
Amoxicillin: B	
Cefadroxil: B	

Table A12-10 Drugs for Use During Pregnancy

Local anesthetics: Safe in therapeutic doses but minimize the use of vasoconstrictors. Antibiotics: Penicillin, cephalosporin, vancomycin, and erythromycin (except estolate form) are safe. Obstetrician should be consulted if other antibiotics are needed. Tetracyclines are absolutely contraindicated due to intrinsic staining of teeth and skeletal bone. Do not use sulfa drugs. Analgesics: Usually preferable to treat the cause of pain rather than to treat patient symptomatically with analgesics. Acetaminophen, hydrocodone, oxycodone, and codeine are considered safe. Nonsteroidal anti-inflammatory agents (including aspirin) and opioids (other than those mentioned above) should be avoided. Avoid naproxen sodium, ibuprofen, propoxyphene, and aspirin. Obstetrician should be consulted if other analgesics are needed. Sedatives: Should be avoided. Obstetrician should be consulted if sedation is needed. Diazepam and nitrous oxide (in early stages) are absolutely contraindicated.
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Table A12-11 Drugs Used in Dentistry Considered Safe While Breastfeeding

Nonsteroidal Anti-Inflammatory Drugs	Cefazolin
Acetaminophen	Ciprofloxacin
Ibuprofen	Clindamycin
Ketorolac	Erythromycin
Naproxen	Penicillin
	Sulbactam
Narcotic Analgesics	Tetracycline
Codeine	
Fentanyl	Local Anesthetics
Meperidine	Lidocaine
Methadone	Procainamide
Morphine	
Antibiotics	Miscellaneous
Amoxicillin	Diphenhydramine
Cefadroxil	Methohexital
Cefazolin	Methylprednisolone
Cefotaxime	Prednisone
Cefoxitin	Prednisolone

Table A12-12 Emergency Medications and Equipment

Injectable Drugs
Epinephrine: 1:1000 dilution, preloaded syringe (1 cc/ml)
Antihistamine: Diphenhydramine (Benadryl®) (chlorpheniramine maleate [Piriton]) 10 cc/ml ampules
Hydrocortisone: 300-mg ampule (100-mg vials of powder for reconstitution) for IV injection
D50W: 50-cc ampule for IV injection, 0.5 g/cc
Epinephrine: 1:10,000 dilution for IV injection (0.1 mg/cc)
Lidocaine: 2% for IV injection, 100 mg/5 cc, 5-cc vial
Atropine for IV injection: 0.1 mg/cc, 10-cc vial
Diazepam for IV injection: 5 mg/cc, 2-cc vial
Narcan for IV injection: 0.4 mg/cc, 1-cc vial
Morphine for IV injection: 10 mg/cc, 19-cc vial
Other Drugs
Oxygen
Albuterol (salbutamol): Metered dose inhaler
Nitroglycerin tablets: 0.4 mg (or metered dose [0.4 mg/release] spray) (sublingual tablets must be <1 year old stock)
Aspirin: 160 to 350 mg
Equipment
Tourniquets
Magill intubation forceps
Syringes, 10-cc volume
Wall suction device, suction tubing, Yankauer suction tip
Oxygen nasal cannula or face mask
Nasopharyngeal airway, oropharyngeal airway sizes 7 and 8
Laryngoscope and endotracheal tubes
14-gauge intravenous catheter for needle cricothyroidotomy
Normal saline: 0.9%, 1000-cc bags
18- and 20-gauge angiocatheter for IV fluid administration
Bag valve mask

(Continued)

Table A12-12 (Continued)

Medication*	Use	Adult dose	Method of action
Atropine	To cause vagal blockade in cases of bradycardia or excess salivation. Avoidance with history of glaucoma and iris–lens adhesions	0.4 to 0.6 mg IM or IV	Muscarinic acetylcholine blockade
Aromatic ammonia	Syncope	1 cap to nose	Noxious stimuli
Aspirin	Acute myocardial infarction	160 to 350 mg PO	Platelet inhibition
Diazepam	Status epilepticus, severe recurrent convulsive seizures. Avoid with hypersensitivity	2 to 5 mg IV	Sedative, muscle relaxant
Diphenhydramine (chlorpheniramine maleate)	Dermatologic allergic reaction. Avoid with infants, lactating mothers, those on monoamine oxidase inhibitors, or with hypersensitivity	10 to 20 mg IV/IM for adult, 0.5 mg/kg dose for child	Antihistamine with anticholinergic and sedative effects
Phenytoin	Control of grand mal status epilepticus. Avoid with hypersensitivity, sinus bradycardia, sinoatrial block, arteriovenous block	50 mg/min IV in normal saline for maximum 15 mg/kg	Anticonvulsant at the motor cortex
Epinephrine	Anaphylaxis, asthma	0.3 cc of 1:1000 adults. 0.01 cc/kg for children	Sympathetic receptor stimulant receptor action
Hydrocortisone	Acute adrenal insufficiency, severe allergic reaction	300 mg IV	Anti-inflammatory adrenal cortical steroid
Albuterol (salbutamol) metaproterenol	Bronchospasm associated with acute and chronic bronchial asthma, or pulmonary emphysema. Avoid with cardiac arrhythmias, tachycardia, and with use of epinephrine	Inhalation of metered dose inhaler 2 puffs/dose	Bronchodilation
Morphine	Pain due to myocardial infarction	4 to 10 mg IM, 2 to 4 mg IV	Narcotic analgesic
Naloxone	Complete or partial reversal of opioid depression	2.0 mg IV, IM, or SC for adult; 0.01 mg/kg IV, IM, SC for child	Pure narcotic antagonist
Sodium bicarbonate	Metabolic acidosis	1 mEq/kg IV	Maintenance of pH

Table A12-12 (Continued)

Succinylcholine	To cause skeletal muscle paralysis for intubation	1.5 mEq/kg IV	Short-acting muscle relaxant and depolarizing agent
Nitroglycerin	Prophylaxis treatment and management of angina	1 to 2 tablets (or metered spray) sublingual or in buccal pouch every 5 min or prophylactically 5 to 10 min prior to strenuous activity	Relaxes smooth muscle, vasodilation

Table A12-13 Federally Controlled Drugs

Controlled Substances Act—United States	
The US Federal Controlled Substances Act of 1970 placed drugs controlled by the Act into five categories, or schedules, based on their potential to cause psychologic and/or physical dependence as well as on their potential for abuse.	
When combined with non-narcotic medicinal ingredients, preparations containing certain narcotics can be placed in Schedules III and V. When combined with one or more non-controlled medicinal ingredients, preparations containing Schedule II barbiturates are placed in Schedule III. Suppository forms of these barbiturates are also controlled in Schedule III.	
Schedules for Federally Controlled Drugs	
Category	Interpretation
I	Includes substances for which there is a high abuse potential and no current approved medical use (e.g., heroin, marijuana, LSD, other hallucinogens, certain opiates and opium derivatives).
II	High potential for abuse. Use may lead to severe physical or psychological dependence. Prescriptions must be written in ink, or typewritten and signed by the practitioner. Verbal prescriptions must be confirmed in writing within 72 hours, and may be given only in a genuine emergency. No renewals are permitted.
III	Some potential for abuse. Use may lead to low-to-moderate physical dependence or high psychological dependence. Prescriptions may be oral or written. Up to five renewals are permitted within six months.
IV	Low potential for abuse. Use may lead to limited physical or psychological dependence. Prescriptions may be oral or written. Up to five renewals are permitted within six months.
V	Subject to state and local regulation. Abuse potential is low; a prescription may not be required.

U.S. Department of Health and Human Services. U.S. Food and Drug Administration. Controlled Substances Act. Title 21—Food and Drugs. Chapter 13—Drug Abuse Prevention and Control. Subchapter I—Control and Enforcement.

Table A12-14 Renal Function: Adjustment of Dosage General Guidelines for use of Various Doses in Renal Failure with Modification in Dose Interval According to Degree of Failure

Drug	Excretion	Normal	Mild renal failure Creatinine clearance 50 to 75 cc/min	Moderate renal failure Creatinine clearance 10 to 50 cc/min	Severe renal failure Creatinine clearance <10 cc/min	Significant dialysis of drug
Narcotic and non-narcotic analgesics						
Codeine	Hepatic >> renal	Every 6 h	Every 6 h	Every 6 h	Every 6 h	Unknown
Meperidine (pethidine)	Hepatic >> renal (10%)	Every 4 h	Every 4 h	Every 4 h	Every 4 h	No (HP)
Acetaminophen (paracetamol)	Hepatic >> renal	Every 4 h	Every 4 h	Every 4 h	Avoid	Yes (H)
Aspirin	Renal	Every 4 h	Every 4 h	Every 4 to 6 h	Every 8 to 12 h	Yes (HP)
Barbiturates and benzodiazepines						
Amobarbital	Hepatic	Every 6 to 12 h	Every 6 to 12 h	Every 6 to 12 h	Every 6 to 12 h	No (HP)
Secobarbital						
Phenobarbital	Hepatic > renal (30%)	Every 8 h	Every 8 h	Every 8 h	Every 8 to 16 h	Yes (HP)
Chlordiazepoxide	Hepatic	Every 8 h	Every 8 h	Every 8 h	Every 8 h	No (HP)
Diazepam	Hepatic	Every 8 h	Every 8 h	Every 8 h	Every 8 h	No (HP)

Table A12-14 (Continued)

Drug	Creatinine clearance normal	>50 cc/min	30 to 50 cc/min	10 to 29 cc/min	<10 cc/min
Amoxicillin/clavulanate	250 to 500 mg q 8 h or 875 mg q 12 h	No change needed		250 to 500 q 12 h	250 to 500 q 24 h
Ampicillin IV	1 to 2 G q 4 to 6 h	1 to 2 G q 6 h	1 to 2 G q 8 h	1 to 2 G q 12 h	1 to 2 G q 12 to 24 h Give after HD
Ampicillin/sulbactam (Unasyn)	1.5 to 3 G q 6 h	1.5 to 3 G q 6 h	1.5 to 3 G q 6 to 8 h	1.5 to 3 G q 12 h	1.5 to 3 G q 24 h Give after hemodialysis
Dicloxacillin	250 to 500 mg q 6 h	No changes necessary			
Penicillin G IV	0.5 to 4 million units q 4 h	No change needed		75% of dose	20 to 50% of dose Give after HD
Penicillin VK	250 to 500 mg q 6 h	No change needed			250 mg q 6 h PO
Ticarcillin/clavulanate (Timentin)	3.1 G q 4 to 6 h	3.1 G q 6 h	2 G q 6 h	2 G q 8 h	2 G q 12 h
Ciprofloxacin	500 to 750 mg q 12 h	500 to 750 mg q 12 h	500 to 750 mg q 12 h	500 to 750 mg q 24 h	500 to 750 mg q 24 h

[Ciprofloxacin] PO IV	400 mg q 8 to 12 h	400 mg q 8 to 12 h	400 mg q 12 h	400 mg q 24 h	400 mg q 24 h
Clindamycin	PO: 150 to 450 mg q 6 h IV: 600 to 1200 mg q 8 h	No changes necessary			
Doxycycline	100 mg q 12 h IV or PO	No changes necessary	Tetracycline of choice for decreased RF		Not antianabolic
Metronidazole (Flagyl)	500 mg IV/PO q 8 h for C. difficile: 250 mg PO QID (200 TDS in the UK)	No changes necessary			

This chart is intended as a guide only. Doses of medications should be verified with a standard reference.

Suggested reading: Munar MY, Singh H. Drug Dosing Adjustments in Patients with Chronic Kidney Disease. Am Fam Physician 75:1487–96. 2007.

Table A12-15 Renal Drugs with Major Excretion Route via Kidneys**Antibiotics**

- Penicillins: Amoxicillin, ampicillin, carbenicillin, dicloxacillin, methicillin, oxacillin, penicillin, ticarcillin
- Tetracyclines: Tetracycline, doxycycline, vancomycin
- Aminoglycosides: Amikacin, gentamicin, streptomycin
- Cephalosporins: Cephalexin, cephalothin, cefamandole (cephapirin, cephradine)

Analgesics

- Non-opioid:
 - Acetaminophen (hepatic excretion): nephrotoxic with chronic use
 - Aspirin: rarely nephrotoxic
 - Non-steroidal anti-inflammatory drugs: most are nephrotoxic.
 - Opioids: most have the liver as the major route; <20% have the renal route.

Appendix 13 Emergency Room Kit

Instruments (color-coded)

- | | |
|--|--|
| 1. Mirror | 12. Tissue pick-ups |
| 2. Locking cotton pliers | 13. Explorer |
| 3. Dental syringe—aspirating | 14. Perio probe |
| 4. Forceps—upper/lower universal, ash, anterior, cowhorn | 15. Calcium hydroxide applicator |
| 5. Elevators—Woodson, Periosteal, number 34, 301, 302, 303 | 16. Spatula |
| 6. Needles 25-, 27-, or 30-g. short and long | 17. Plastic instrument |
| 7. Curettes, scalers | 18. Rubber dam frame, punch, forceps |
| 8. Scalpel handle (disposable) and blades | 19. Dappen dish |
| 9. Needle holder | 20. Flashlight, if operating light not available |
| 10. Hemostat (Kelly) | 21. Composite instrument |
| 11. Scissors (suture) | 22. X-ray holder (XCP, Snap-a-Ray®, styrofoam stabs) |

Paper or disposable products

- | | |
|------------------------------------|----------------------------------|
| 1. Cotton pellets and cotton rolls | 4. Alcohol wipes |
| 2. Gauze—2 × 2s and 4 × 4s | 5. Calcium hydroxide mixing pads |
| 3. Cotton-tipped applicators | 6. Etching pellets or brush |

(Continued)

7. Rubber dam
8. Appropriate suture material
9. Floss
10. Irrigating syringe
11. Number 11 and 15 blades

Materials

1. Calcium hydroxide/barium sulfate paste with needles
2. Composite resin—self-curing or light activated; etching liquid; bonding agent
3. Topical anesthetic
4. Calcium hydroxide liner
5. Anesthetic—lidocaine 2%, 1:100,000 epi; mepivacaine; bupivacaine
6. Wire or “nylon” line for splinting
7. Unreinforced ZOE
8. Absorbable gelatin sponge/surgicel/Avitene™
9. Vaseline®

Miscellaneous

1. Surgical tray
2. Additional forceps and elevators
3. Wire cutters

12. Wooden bite stick
13. Rubber gloves
14. Endodontic irrigating syringes/tips
15. Iodoform gauze (for dry socket)

10. Temporary cement
11. Reinforced ZOE
12. 0.030 Wire
13. Erich arch bar
14. No. 0, 2 intraoral films
15. Dry socket paste
16. Topical thrombin (5,000 µ/cc, 10 000 µ/cc)
17. Save-a-Tooth® solution/Hank’s balanced salt solution
18. Cavit, paper points, barbed broches (pulp extirpation)

4. “Orthodontic” pliers
5. Curing light for composite
6. Endodontic files, solutions, and medicaments

Appendix 14 Facial Pain: Diagnostic Features

Disorder	Etiology	Signs and symptoms	Tests	Therapy considerations
Myofascial pain dysfunction (MPD)	Bruxism, clenching, nail biting, gum chewing, lip or cheek biting, pipe smoking, etc. Aberrant occlusion, history of trauma, displaced disc or unknown. Rare in <18 years old. Secondary to "stress," anxiety and sometimes depression	Unilateral pain, joint noise, limited function, tenderness to palpation of muscles of mastication, deviation of mandible on opening, emotionally stressed individual, parafunctional habits		Emergency: Rest joints and eliminate habits, moist heat, muscle relaxants. Long term splint, refrigerant spray, anesthetic intramuscular injection, counseling. Occlusal adjustment only if clearly contributes to the problem and only when no longer in muscle spasm
Temporomandibular dysfunction (TMD)	Most commonly osteodegenerative arthritis (although rheumatoid arthritis, infection and trauma also possible). Rare in <18 years old	Pain in joint, crepitus, deviation to affected side, limitation in function	CT or MRI scan to show disc position if refractory to conservative treatment. TMJ radiograph may show flattening of articular surfaces, spurring of condyles, narrowing of joint, space(s), and ankylosis	Moist heat, anti-inflammatory drugs, cortisone injection, elimination of oral habits, eliminate gross occlusal prematurities

(Continued)

Disorder	Etiology	Signs and symptoms	Tests	Therapy considerations
Maxillary sinusitis	Viral or bacterial infection of sinus mucosa	Headache, increased temperature, malaise, edema and redness beneath eyes, worst in morning, improves with sitting up, tenderness on sinus palpation	Waters and/or panorex film may suggest sinusitis, but not diagnostic	Antibiotics, decongestants, consider referral to physician/otolaryngologist
Ear pain	External otitis, foreign body, furunculosis, impacted cerumen, otitis media, mastoiditis, blocked Eustachian tube, nasopharyngeal carcinoma	Ear pain must be differentiated from "otomandibular" syndrome associated with myofascial pain dysfunction	Examine ear canal and TM	Refer to otolaryngologist if otalgic in origin
Iatrogenic pain	Misdirected mandibular injection. Prolonged wide opening during dental procedure	Trismus and pain in area of medial pterygoid muscle 3 to 4 days postinjection or procedure, and lasting up to several weeks		Analgesics, moist heat, soft diet, jaw-opening exercises
	Altered occlusion from high restoration	Pain in one or more teeth and/or face prosthesis	Check for occlusion prematurities	Adjust occlusion
Parotid gland disease	Infection, tumor	Fever, enlarged gland, purulent exudate from duct	Biopsy, sialogram or CT/MRI	Aggressive antibiotic treatment for infection. May be prolonged treatment in the case of childhood parotitis
Temporal arteritis	Granulomatous lesion of temporal artery	Pain in front of ear, pain on mastication, visual impairment. Similar to MPD	C reactive protein, temporal artery biopsy (lymphocytic infiltration, and giant cells)	Referral to medical specialist immediately for corticosteroid treatment

Disorder	Etiology	Signs and symptoms	Tests	Therapy considerations
Eagle's syndrome	Elongation of styloid process	Pain on swallowing, turning of head, extreme pain on palpation of tonsilla fauces	Panoramic, radiograph	Surgical
Trigeminal neuralgia	Disorder of branches of trigeminal nerve		Anesthetic to trigger zone results in total relief	Referral to specialist
Migraine	Pain may be associated with headache	Unilateral temporal pain, with spasm of temporal muscle, stimulated by vasodilation	No tests. Often have prodromal sensory visceral effects	Referral to specialist
Neoplasms	Tumors involving parotid, trigeminal nerve, nasopharynx, sphenoid sinus	Pain may be associated with numbness or loss of motor function	Direct visualization of all mucosal surfaces and radiographic examination	Referral to appropriate surgical service (e.g., otolaryngologist)
Posttraumatic	Trauma	Set off by deep pressure at the injury site. Dysesthesias and neurotropic effects noted	Nerve block results in partial relief	Analgesics are effective
Systemic disease	Variable hereditary and emotional factors	Pain is spontaneous, usually in appendages, extraocular muscles. Dysesthesias noted and neurotropic effects in hands	Nerve block results in partial relief	Analgesics are effective

Appendix 15 Fluid Management

Table A15-1 Fluid Deficits

Calculation of postoperative fluid deficit

Estimated fluid requirement (EFR) per hour:

First 10 kg: 4 cc/kg (100 cc/kg/day)

Second 10 kg: 2 cc/kg (50 cc/kg/day)

Above 20 kg: 1 cc/kg (25 cc/kg/day)

Example: EFR for a 70-kg patient = $(10 \times 4) + (10 \times 2) + (50 \times 1)$
 $= 40 + 20 + 50$
 $= 110 \text{ cc/h}$

Estimated fluid deficit (EFD) = EFR times the number of hours since last oral intake:

Example: EFD for 70-kg patient NPO (nothing by mouth) for 8 hours

$\text{EFR} \times 8 = 110 \text{ cc/h} \times 8 \text{ h} = 880 \text{ cc}$

Replacement of blood losses:

Crystalloid fluid: 3 times estimated blood loss (EBL)

Colloid or blood: 1 times EBL

Example: For EBL of 400 cc, crystalloid fluid replacement should be $3 \times 400 = 1,200 \text{ cc}$

Total postsurgical fluid deficit (TPFD):

$\text{EFD} + (\text{blood losses} \times 3) - \text{fluid replaced by anesthesia during surgery}$

Example: A 70-kg patient is NPO for 8 hours, has 400 cc of surgical blood loss, and receives 1,500 cc of crystalloid during surgery

$\text{TPFD} = 880 \text{ cc} + 1,200 \text{ cc} - 1,500 \text{ cc} = 580 \text{ cc}$

Insensible losses are generally negligible in most orofacial procedures.

Table A15-2 Types of Intravenous Fluid (Milliequivalents/L)

IV solution	NA	K	Cl	Bicarbonate	Calories
Ringer's lactate	130	4	109	28	0
Ringer's solution	147	4	155	0	0
Normal saline (0.9%)	154	0	154	0	0
Lactated Ringer's with dextrose	130	4	109	28	170
Dextrose 2.5% in NaCl 0.45%	77	0	77	0	85
Dextrose 5% in Ringer's lactate	148	4	156	0	170
Dextrose 5% in 2% NaCl	34	0	34	0	170
Dextrose 5% in 0.33% NaCl	56	0	56	0	170
Dextrose 5% in 0.45% NaCl	77	0	77	0	170
Dextrose 5% in 0.9% NaCl	154	0	154	0	170
Dextrose 10% in 0.9% NaCl	154	0	154	0	340
Dextrose 5% in water	0	0	0	0	200
Dextrose 10% in water	0	0	0	0	400

Appendix 16 Glasgow Coma Scale

Eye opening response

- Spontaneous—open with blinking at baseline: **4 points**
- To verbal stimuli, command, speech: **3 points**
- To pain only (not applied to face): **2 points**
- No response: **1 point**

Verbal Response

- Oriented: **5 points**
- Confused conversation, but able to answer questions: **4 points**
- Inappropriate words: **3 points**
- Incomprehensible speech: **2 points**
- No response: **1 point**

Motor Response

- Obeys commands for movement: **6 points**
- Purposeful movement to painful stimulus: **5 points**
- Withdraws in response to pain: **4 points**
- Flexion in response to pain (decorticate posturing): **3 points**
- Extension response in response to pain (decerebrate posturing): **2 points**
- No response: **1 point**

References

- Teasdale G, Jennett B. Assessment of Coma and Impaired Consciousness. *Lancet* 304:81–84. 1974.
- Teasdale G, Jennett B. Assessment and Prognosis of Coma after Head Injury. *Acta Neurochir* 34:45–55. 1976.

Categorization

Coma; no eye opening, no ability to follow commands, no word verbalizations (3–8)

Head Injury Classification

Severe Head Injury: Glasgow Coma Scale (GCS) score of 8 or less

Moderate Head Injury: GCS score of 9 to 12

Mild Head Injury: GCS score of 13 to 15

Adapted from: Advanced Trauma Life Support: Course for Physicians, American College of Surgeons, 1993.

Disclaimer

Based on motor responsiveness, verbal performance, and eye opening to appropriate stimuli, the Glasgow Coma Scale was designed and should be used to assess the depth and duration of coma and impaired consciousness. This scale helps to gauge the impact of a wide variety of conditions such as acute brain damage due to traumatic and/or vascular injuries or infections, metabolic disorders (e.g., hepatic or renal failure, hypoglycemia, diabetic ketosis), etc.

Appendix 17 Hepatitis B Virus Infection

Interpretation of Hepatitis B Panel

Tests	Results	Interpretation
HBsAg	negative	Susceptible
anti-HBc	negative	
anti-HBs	negative	
HBsAg	negative	Immune due to natural immunity
anti-HBc	positive	
anti-HBs	positive	
HBsAg	negative	Immune due to hepatitis B vaccination
anti-HBc	negative	
anti-HBs	positive	
HBsAg	positive	Acutely infected
anti-HBc	positive	
IgM anti-HBc	positive	
anti-HBs	negative	Chronically infected
HBsAg	positive	
anti-HBc	positive	
IgM anti-HBc	negative	Interpretation unclear; four possibilities: 1. Resolved infection (most common) 2. False-positive anti-HBc, thus susceptible 3. "Low level" chronic infection 4. Resolving acute infection
anti-HBs	negative	
HBsAg	negative	
anti-HBc	positive	
anti-HBs	negative	

(Continued)

Hepatitis B surface antigen (HBsAg): A protein on the surface of HBV; it can be detected in high levels in serum during acute or chronic HBV infection. The presence of HBsAg indicates that the person is infectious. The body normally produces antibodies to HBsAg as part of the normal immune response to infection. HBsAg is the antigen used to make hepatitis B vaccine.

Hepatitis B surface antibody (anti-HBs): The presence of anti-HBs is generally interpreted as indicating recovery and immunity from HBV infection. Anti-HBs also develops in a person who has been successfully vaccinated against hepatitis B.

Total hepatitis B core antibody (anti-HBc): Appears at the onset of symptoms in acute hepatitis B and persists for life. The presence of anti-HBc indicates previous or ongoing infection with HBV in an undefined time frame.

IgM antibody to hepatitis B core antigen (IgM anti-HBc): Positivity indicates recent infection with HBV (less than or equal to 6 months). Its presence indicates acute infection.

www.cdc.gov

Centers for Disease Control and Prevention. A Comprehensive Immunization Strategy to Eliminate Transmission of Hepatitis B Virus Infection in the United States: Recommendations of the Advisory Committee on Immunization Practices (ACIP); Part I: Immunization of Infants, Children, and Adolescents. *MMWR* 54 (No. RR-16):4. 2005.

Appendix 18 HIV Test Technologies

Performance attributes and potential applications of HIV test technologies approved by the U.S. Food and Drug Administration (FDA) for diagnostic use

Test type	Specimen (mode of collection)	Test complexity*	Screening: confirmatory	Strains detected†	Provision of results	Advantages	Potential settings
Standard HIV test	Serum or plasma (phlebotomy)	High	Enzyme immunoassay (EIA); Western blot or immuno-fluorescence assay (IFA)	HIV-1 and HIV-2	HIV negative: Test result at return visit (typically a few days to 1 to 2 weeks) HIV positive: Confirmed result at return visit	■ High sensitivity ■ Rare false-positives ■ High-volume processing ■ Utility for testing for other conditions (e.g., sexually transmitted diseases [STDs])	■ Blood screening ■ Various settings and populations
Rapid test	Serum, plasma, whole blood (phlebotomy, finger stick)	Moderate ^s	Rapid EIA; Western blot /IFA [†]	HIV-1	HIV negative: Test result at time of testing (typically 10 to 60 minutes) HIV positive: Preliminary positive test result at time of testing;** confirmed result at return visit	■ Convenience ■ Increased receipt of test results ■ Use in urgent medical circumstances (e.g., postexposure prophylaxis)	■ Setting with low return rates ■ Perinatal/labor and delivery for prophylaxis ■ Healthcare setting for decisions regarding postexposure prophylaxis
Home sample collection test ^{††}	Dried blood spot (finger stick)	High	EIA; Western blot/IFA	HIV-1	HIV negative: Test result when client telephones (typically 3 to 7 days) HIV positive: Confirmed result when client telephones	■ Convenience ■ Anonymity ■ Privacy ■ Conservation of public resources	■ Outreach settings ■ Community-based settings ■ Syringe exchange programs ■ Rural areas ■ Settings serving clients not at increased risk ■ Home

(Continued)

Test type	Specimen (mode of collection)	Test complexity*	Screening: confirmatory	Strains detected†	Provision of results	Advantages	Potential settings
Oral fluid test	Oral mucosal transudate (oral fluid collection device)	High	EIA; oral mucosal transudate Western lot	HIV-1	HIV negative: Test result at return visit (typically 1 to 2 weeks) HIV positive: Confirmed result at return visit	■ Noninvasive ■ Nontechnical collection ■ No venipuncture ■ Decreased infectious hazard ■ Utility in nonclinical settings	■ Outreach settings ■ Community-based settings ■ Syringe exchange programs ■ Drug treatment centers ■ Adolescent and school-based clinics and university health centers
Urine-based test	Urine (urine cup)	High	EIA; urine Western blot	HIV-1	HIV negative: Test result at return visit (typically 1 to 2 weeks) HIV positive: Test result at return visit; further confirmation by blood sample recommended because of lower specificity of urine Western blot compared with serum-based Western blot/IFA	■ Noninvasive ■ Nontechnical collection ■ No venipuncture ■ Decreased infectious hazard ■ Utility in nonclinical settings ■ Utility for testing other conditions (e.g., STDs)	■ Outreach settings ■ Community-based settings ■ Syringe exchange programs ■ Drug treatment centers ■ Adolescent and school-based clinics and university health centers

*Complexity of specimen collection and testing as categorized by the Clinical Laboratory Improvement Amendments (CLIA): Schochetman G, George JR, (Eds.). *AIDS Testing: A Comprehensive Guide to Technical, Medical, Social, Legal, and Management Issues*, 2nd Ed. Springer-Verlag, New York. 1994.

†All licensed enzyme immunoassays (EIAs) detect HIV-1, but not all detect HIV-2. EIAs that can detect HIV-1 and HIV-2 are required for blood donor screening and are recommended for diagnostic screening only where HIV-2 infection is likely. No licensed confirmatory test exists for HIV-2. Although current tests detect most HIV-1 group O infections, few detect all such infections.

‡The one rapid test licensed by FDA, Abbott Murex Single Use Diagnostic System (SUDS) HIV-1 test (Abbott Laboratories, Inc., Abbott Park, Illinois), is classified as a moderate-complexity test and requires on-site laboratory testing capability. Future rapid tests could be classified by CLIA as "waived" and not require on-site laboratory testing capability, depending on the expertise required to perform the test correctly.

*Future rapid tests might be able to be confirmed with a second rapid test to provide an immediate test result with high sensitivity, specificity, and predictive value comparable with EIA/Western blot: Stetler HC, Granade TC, Nunez CA, et al. Field Evaluation of Rapid HIV Serologic Tests for Screening and Confirming HIV-1 Infection in Honduras. *AIDS* 11:369-75, 1997.

**Information on providing "preliminary" positive test results from a single rapid test is available elsewhere: CDC. Update: HIV Counseling and Testing Using Rapid Tests—United States, 1995. *MMWR* 47:211-5, 1998.

††Home sample collection is different from home-use testing. FDA has approved home sample collection, but not home-use HIV test kits: Kassler WJ. Advances in HIV Testing Technology and Their Potential Impact on Prevention. *AIDS Educ Prev* 9(suppl B):27-40, 1997.

Appendix 19 Hospital Charting

Table A19-1 Examples of Hospital Charts

BRIEF HISTORY AND PHYSICAL EXAMINATION RECORD

Department of Dentistry

HISTORY AND PHYSICAL EXAMINATION

Date: 01 December 2011

Time: 14:00

Informant: Patient, patient's old chart

History of present illness: Patient is a 33 yo white male admitted for extraction of teeth #1, 2, 3, 14, 15 16, 17, 18, 19, 30, 31 and 32 as well as restorative dental treatment. He has had many admissions for chronic kidney disease s/p cadaveric kidney transplant in 2001, which has subsequently failed and has been removed. He is on dialysis, with a shunt, on M, W, F, at the Dialysis Unit. He also has chronic hepatitis B and prosthetic mitral valve.

Past medical history: HBV positive, chronic active carrier with some cirrhosis. Renal failure, M, W, F via right arm shunt.

Hospital admissions: Removal of transplanted kidney, exploratory laparotomy (September 2001).

Operations: See above. Also, T & A as a child. Porcine prosthetic valve placed 2003.

Current medications: Benadryl®, Amphogel®, cimetidine, multivitamins, folic acid, Lomotil®.

Allergies: None known.

Social history: (+) EtOH, cigarettes. Single, unemployed, lives with sister.

Review of systems: This patient denies rheumatic fever, myocardial infarction, cerebrovascular accidents, thyroid problems, coagulopathy, diabetes, asthma, and emphysema.. The patient has a prosthetic mitral valve, chronic hepatitis B, chronic GI hypermotility, a cadaveric kidney transplant and is currently undertaking dialysis.

(Continued)

Table A19-1 (Continued)

Physical examination: Vital signs: B/P 100/70 mmHg, temp 98.6°F (37°C), pulse 72, R 20.
General: 33 yo male, slightly obese in NAD.

HEENT: NC/AT, PERRLA, EOMs full without nystagmus. Neck supple. Pharynx clear. Multiple decayed teeth; advanced periodontal disease; 4 impacted 3rd molars.

Lungs: Clear to A/P.

Heart: RRR nl, S1, S2, II/VI SEM.

Abdomen: BS+, soft, non-tender, 3+ hepatomegaly, without organomegaly.

Rectal: Deferred.

Musculoskeletal: Extremities slightly wasted. Full range of motion and reflexes.

Neurological: Alert and oriented x3. Cranial nerves II-VI grossly intact.

Diagnosis:

1. Impacted 3rd molar teeth x4, gross caries x8, and advanced periodontal disease
2. Mitral valve prolapse
3. Chronic hepatitis B
4. Chronic renal failure

Plan: Extractions x12) and restorative dental treatment 17 September 2003 under general anesthesia with pre-operative antibiotic prophylaxis.

David A. Jones, DDS

PERI-OPERATIVE NOTES

DEPARTMENT OF DENTISTRY

OPERATIVE NOTE

Date: 01 December 2011

Time: 14:00

Preoperative diagnosis: Caries, impacted teeth #1, 16, 17 and 32 and caries and periodontal disease associated with #2, 3, 14, 15, 18, 19, 30 and 31. Chronic renal disease. Chronic hepatitis B.

Postoperative diagnosis: Same.

Surgeon: Dr. Jones

Procedure: Extraction of teeth #1, 2, 3, 14, 15, 16, 17, 18, 19, 30, 31 and 32 along with restorative treatment, and scaling under prophylaxis for prosthetic valve.

Anesthesia: General (nasotracheal).

EBL: 200cc

Fluids: 200cc 0.9% NaCl

Complications: None.

Plan: Hct on floor. If <25, 1 unit washed, irradiated prbc.

Hematocrit in am. Discharge to home tomorrow.

D.A. Jones, DDS

DEPARTMENT OF DENTISTRY

POST-OPERATIVE NOTE

Date: 01 December 2011

Time: 14:00

Vital signs: Stable T 98.9°, BP 100/70, P 72 R 16

Extraction sites: Without bleeding. Mild swelling as expected.

Patient awake, alert, comfortable

Hct 29 IV TKO (to keep open)

Plan: Discharge patient to home

Rx: Oxycodone/acetaminophen [paracetamol] po q4h PRN. Disp. 10

Routine meds

Return to dental clinic 08 December at 09:00h.

D.A. Jones, DDS

Table A19-1 (Continued)

DEPARTMENT OF DENTISTRY FACULTY		
DISCHARGE NOTE		
Date: 01 December 2011		
Time: 14:00		
Patient name: John Doe		
Hospital number: R 7699 30571		
Date of admission: 01 December 2011		
Date of discharge: 01 December 2011		
Staff physician: David A. Jones, DDS		
Family physician: James Smith, MD		
History of present illness: Mr. Doe was admitted 01 December 2011 for removal of eight grossly decayed molars and four impacted third molars restorative dentistry and scaling under general anesthesia and prophylaxis. Patient has not received routine dental care since childhood.		
Past medical history: Significant for chronic renal disease. He received a cadaveric renal transplant that failed and was removed. The patient is on dialysis Mondays, Wednesdays and Fridays at the Kidney Center. He has a shunt in place. He has chronic hepatitis B and a prosthetic mitral valve. He has had multiple hospital admissions for procedures including kidney transplant, removal of the transplant, and exploratory lap.		
Medications on admission: Benadryl® 25 mg po PRN itch, Maalox® 600mg po tid, cimetidine 300mg po bid, multivitamin with iron 1 tab po qd, folic acid 50ug po qd, Motrin® 600mg po q6h for pain, Lomotil®.		
Laboratory data on admission: sodium 131, chloride 95, potassium 5.8, carbon dioxide 25, creat. 9.2, BUN 36. WBC 5.0, Hct 16.5, PT 12.6/12.2, PTT 30.5.		
Hospital course: The patient was admitted 26 September 2003 and dialyzed that evening. He was transfused 27 September 2003 preoperatively and intraoperatively with two units of irradiated, washed packed red blood cells. He was taken to the operating room that afternoon where, under general anesthesia, teeth #1, 2, 3, 14, 15 16, 17, 18, 19, 30, 31 and 32 were removed and routine dental restorations were done on the remaining teeth. His postoperative course was uneventful and he was discharged the evening of 27 September 2003 with a hematocrit of 28. He is to be followed by Dr. David Jones.		
Discharge diagnosis: Chronic renal failure. Chronic hepatitis B. Prosthetic heart valve. Multiple extractions, dental restorations and scaling while in the hospital.		
Operations and procedures: Extraction of teeth #1, 2, 3, 14, 15 16, 17, 18, 19, 30, 31 and 32 restorative dentistry, dental scaling. Estimated disability: None.		
DA Jones, DDS cc: Dr Sigmon		
PERI-OPERATIVE ORDERS		
DEPARTMENT OF DENTISTRY		
PRE-OPERATIVE ORDERS		
Date	Time	Physician's orders
01 Dec 11	14:00	Admit to dental service, Dr Jones Diagnosis: Caries, impacted teeth #1, 16, 17 and 32 and caries and periodontal disease associated with #2, 3, 14, 15, 18, 19, 30 and 31. Chronic renal failure and chronic hepatitis. Prosthetic mitral valve. (Continued)

Table A19-1 (Continued)

Condition: Good Allergies: None known Vital signs: Per routine Activity: Ad lib Diet: Ad lib/NPO after midnight Meds: Benadryl® 25 mg PO PRN itch Maalox® 600 PO tid Cimetidine 300 mg PO bid Multivitamin with iron 1 tab PO qd Folic acid 50 PO qd Penicillin G (dose) IV on call to OR Renal consult Dialysis this pm. Transfuse 2 units packed rbc; IV : 0.9% NaCl TKO			DA Jones, DDS
DEPARTMENT OF DENTISTRY			
POST-OPERATIVE ORDERS			
Date	Time	Physician's orders	
01 dec 11	18:00	Post-Op Orders: Admit to floor via recovery room Diagnosis: Caries, impacted teeth #1, 16, 17 and 32 and caries and periodontal disease associated with #2, 3, 14, 15, 18, 19, 30 and 31, restorative treatment, dental scaling. Chronic renal failure. Chronic hepatitis B. Prosthetic mitral valve. Condition: Stable Allergies: None known Vital signs: Per routine Activity: Bed rest tonight; Ad lib tomorrow Diet: Clear liquids; advance to soft diet as tolerated IV: 0.9% NaCl 75 cc/h until adequate POs then TKO O₂: 40% humidified O₂ via mask 8 hours to prevent hypoxia Meds: Benadryl® 25 mg PO PRN itch Maalox® 600mg PO tid Multivitamin with iron 1 tab PO qd Folic acid 50mg PO qd Oxycodone/acetaminophen (co-codanol) PO q4h PRN pain Labs: Hct this evening—if less than 25, transfuse 1 unit irradiated, washed rbc. Hct in am Nursing: HOB 30° Ice to side of face 20min/hour 12 hours No rinsing or spitting x24 hours	D.A. Jones DDS

Table A19-1 (Continued)

DEPARTMENT OF DENTISTRY		
DISCHARGE ORDERS		
Date	Time	Physician's orders
01 Dec 11	20:00	Discharge to home Return to dental clinic 30 September 2003 at 09:00. D.A. Jones DDS
OPERATIVE REPORT		
DEPARTMENT OF DENTISTRY		
OPERATIVE REPORT		
Preoperative diagnosis: Impacted teeth #1, 16, 17 and 32 and caries and periodontal disease associated with #2, 3, 14, 15, 18, 19, 30 and 31. Multiple other carious teeth. Periodontal disease. Chronic renal failure. Hepatitis B. Prosthetic mitral valve. Postoperative diagnosis: Same Operations: Removal of teeth #1, 2, 3, 14, 15, 16, 17, 18, 19, 30, 31 and 32, Routine restorative treatment, scaling. Surgeon: David A. Jones, DDS Assistant: G. V. Black, III, DDS Anesthesia: General nasotracheal Indications for operation: Patient is 33 yo white male with grossly decayed teeth #2, 3, 14, 15, 18, 19, 30 and 31, along with deep horizontally impacted teeth #17 and 32 and deep vertically impacted teeth #1 and 16. The patient has chronic renal disease for which he is now dialyzed through a shunt in his right arm. He has chronic hepatitis B and a prosthetic mitral valve. Procedure: The patient was brought to the operating room with an intravenous line in place, through which he was receiving his second unit of washed, irradiated packed red blood cells. He had received penicillin prophylaxis on call to the OR. Once under adequate general anesthesia via nasotracheal intubation, the patient was prepped and draped in the usual manner. A rubber dam was placed to isolate all teeth from second premolar to second premolar, in the maxilla and mandible. The maxillary lateral and central incisors were prepared on the gingival third of the buccal surface. All four maxillary premolars required MOD amalgams with a deep excavation on the distal of #13, requiring vitrebond base. Matrix bands and wedges were placed. The amalgam was packed and carved. The lower right premolars required excavations and the placement of amalgam on the gingival third of the buccal surface. All teeth except the molars were gross scaled using curettes. The field was irrigated and suctioned dry. The rubber dam was removed. The first and second molars were removed with elevators and forceps starting in the upper left quadrant with the second molar, first molar and then third molar. An incision was made over the maxillary third molar region. The tissue was reflected. An air drill was utilized to remove overlying bone. The tooth was identified, and removed with elevators. The area was curetted, and irrigated with normal saline and closed with 3-0 chromic gut suture. The lower left, upper right and lower right 3rd molars were extracted in a similar manner. The mouth was irrigated with normal saline and the throat pack was removed. The patient was brought to the Recovery Room awake and responsive. D.A. Jones DDS		

Table A19-2 Examples of Emergency Room Admissions

**EMERGENCY ROOM ADMISSION HISTORY AND PHYSICAL
ORAL AND MAXILLOFACIAL SURGERY**

Date: 02 December 11

Time: 04:30

Patient name: Darryl Johnson

Chief complaint: 'My face hurts and I can't get my teeth together'

History of present illness: This 27 yo male was involved in an alleged act of interpersonal violence outside of a nightclub approximately 2.5 hours ago. He reports that he had been consuming alcohol since early last evening. He says that three men beat and kicked him as he was leaving the club. He apparently lost consciousness for a brief period and when he became responsive was lying in a pool of blood. Passers-by summoned an ambulance, which brought the patient to the hospital.

Past medical history: This patient denies rheumatic fever, murmur, myocardial infarction, cerebrovascular accidents, thyroid problems, hepatitis, diabetes, coagulopathy, asthma, and emphysema, or foreign bodies.

Hospitalization: Gun shot wound right abdomen in 1998, treated at County Hospital.

Operations: As above

Medications: None

Allergies: Penicillin

Social history:

EtOH: Patient reports approximately 40 drinks per week.

Tobacco: 24 pack-years (or give the number of cigarettes per day).

Other recreational drug use: Denies.

Review of systems:

Skin: Multiple scars from previous trauma.

Head: No previous history of head injury.

Eyes: No history of visual disturbances.

Ears: No hearing disturbances, tinnitus, vertigo, infections.

Nose and sinuses: No history of trauma or sinusitis.

Mouth and throat: Multiple teeth previously extracted, occasional sore throat.

Neck: No lumps, goiter, or pain.

Respiratory: No cough, wheezing, pneumonia, TB.

Cardiac: No known cardiac disease or HTN; no dyspnea, orthopnea, chest pain, or palpitations.

GI: Good appetite; no nausea, vomiting, indigestion, diarrhea, bleeding, constipation, pain, jaundice, gallbladder, or liver problems.

Urinary: No dysuria, frequency, hematuria, or nocturia.

Genito-reproductive: No abnormalities or dysfunction.

Musculoskeletal: No joint pain, muscular pain, or functional disturbances.

Neurologic: No fainting, seizures, motor or sensory loss, no memory disturbances.

Psychiatric: No known psychiatric illness.

Endocrine: No thyroid dysfunction, temperature intolerance, diaphoresis, or diabetes.

Hematologic: No history of excessive bleeding, no anemia.

Physical examination:

Vital signs: Pulse 84 regular, R 20, BP 140/86 mmHg, temp 98.5°F (37°C) (axillary).

Skin: R abdominal scar secondary to old GSW, multiple scars on upper extremities from previous lacerations.

Table A19-2 (Continued)

Head: Contusions and abrasions over R occipital scalp and R forehead, moderate edema over L face.

Eyes: Visual acuity grossly normal, subconjunctival hemorrhage O.S., pupils react to light, mild anisocoria, EOMI, normal retinal exam, anterior chamber clear.

Ears: Impacted wax obscures R TM, L TM intact, L EAC narrowed secondary to edema, pain to palpation over L tragus and preauricular region, auditory acuity grossly normal, no hemorrhage or drainage.

Nose: Nasal bridge mobile and tender to palpation, intranasal exam reveals blood clots and areas of active bleeding, septal deviation and edema obstructing nasal airway.

Mouth: R posterior open bite, only occlusal contact on L posterior molars: mucosal color normal, no oropharyngeal lesions, missing teeth numbers (give the teeth numbers).

Neck: Tender to palpation, trachea midline, edema in L submandibular region.

Nodes: None palpable.

Thorax and lungs: Thorax symmetrical, no tenderness to palpation, clear to auscultation and percussion.

Heart: RRR without S3, S4, or murmur, no bruits, JVP normal.

Abdomen: Old RUQ abd scar; no masses or tenderness; liver, spleen, kidneys not palpable, liver of normal size.

Genitalia: Normal, without lesions.

Rectal: Negative, brown stool, negative for occult blood.

Peripheral vascular: Pulses all 4+, no pedal edema or ulcers.

Musculoskeletal: No deformities, normal ROM.

Neurologic: CN II–XII grossly normal with exception of left V2 and V3 (describe the deficit), motor and sensory function otherwise intact, DTR 2+ bilat and equal, mental status apparently normal.

Radiographs: Left mandibular ramus fracture, naso-ethmoidal and orbital fracture extending through left infraorbital foramen and medial aspect of left infraorbital rim.

Assessment: This patient is an otherwise healthy 27 yo male who was allegedly assaulted this morning. Although he reports a brief episode of unconsciousness, he is alert and oriented 3. He is presently wearing a cervical collar and is on a spine board. Left mandibular ramus and naso-ethmoidal and orbital fracture. Facial contusions and abrasions.

Plan: Admit to oral and maxillofacial surgery, Dr V. H. Kasanjian.

IV antibiotics, to OR for ORIF of facial fractures.

W. Guy, DDS

ADMISSION ORDERS AND CONSULTATION REQUEST

ORAL AND MAXILLOFACIAL SURGERY

ADMISSION ORDERS

Date	Time	Physician's orders
2 Dec 11	05:00	Admit to oral and maxillofacial surgery—Dr Kasanjian. Diagnosis: Left mandibular ramus fracture, naso-ethmoidal and orbital fractures. Condition: Good. Allergies: PCN. Vitals: q 4 h. Activity: Bed rest. Diet: NPO. Void on call to OR.

(Continued)

Table A19-2 (Continued)

Meds: Ancef® 1 g (cefuroxime 750mg) IV stat, then 500mg q 6 h, Demerol® (pethidine) 50mg/ Phenergan® 25 mg IM q 4 hrs PRN pain IV at 150mL/h.
Please page resident, Dr. Guy, at 2568 when patient called to OR or if any problems or questions.

W. Guy, DDS

ORAL AND MAXILLOFACIAL SURGERY

NEUROSURGERY CONSULTATION REQUEST

Date: 2 December 2011

Time: 05:15

To: Neurosurgery

From: Oral and maxillofacial surgery

Request: 27 yo male with left mandibular ramus and naso-ethmoidal and orbital fractures.

Allegedly assaulted early this morning. Please evaluate C-spine preoperatively. Patient for ORIF of facial fractures, with significant cervical manipulation.

W. Guy, DDS

OPERATIVE AND PROGRESS NOTES

ORAL AND MAXILLOFACIAL SURGERY

PRE-OPERATIVE NOTE

Date: 2 December 2011

Time: 05:00

Preoperative diagnosis: Left mandibular ramus and naso-ethmoidal and orbital fractures.

Operation planned: ORIF facial fractures.

Anesthesia: General/nasal ET tube.

Surgeons: V H Kazanjian DDS, MD

Resident: W Guy, DDS

ECG: NSR

CXR: NAD

Allergies: Penicillin

UA: Yellow/clear, sp gr 1.014, pH 6.9, micro: neg

Labs:

135	93	11	Hgb 13.5	PT 11.5	INR 1.0
5.0	29	0.9	Hct 40.5	PTT 22	

Consent: Signed

Neurosurgery consult: Pt seen, C-spine cleared

W. Guy, DDS

ORAL AND MAXILLOFACIAL SURGERY

OPERATIVE NOTE

Date: 2 December 2011

Time: 11:00

Preoperative diagnosis: Left mandibular ramus, and naso-ethmoidal and orbital fractures

Postoperative diagnosis: Same

Surgeons: V H Kazanjian DDS, MD and W Guy, DDS

Anesthesia: General/nasal ET tube

Table A19-2 (Continued)

EBL: 100cc
 Fluids: 1500cc IV crystalloids
 Specimens: None
 Cultures: None
 Complications: None

W. Guy, DDS

ORAL AND MAXILLOFACIAL SURGERY

PROGRESS NOTE

Date: 2 December 2011
 Time: 17:00
 Patient without complaint, mild/mod discomfort from edema, AVSS, B.P. 125/85, P 80, R 18
 Oral intake: 200cc, urine output: 700cc
 Lungs: clear. Out of bed to bathroom, occlusion stable, dressings intact, surgical wounds closed primarily
 Diagnosis: Patient following normal post-op course
 Plan: Encourage PO intake and ambulation, TKO (to keep open) or KVO (keep vein open) anticipate discharge in morning

W. Guy, DDS

ORAL AND MAXILLOFACIAL SURGERY

PROGRESS NOTE

Date: 2 December 2011
 Time: 08:00
 Patient without complaint. Mild discomfort controlled with ibuprofen. Vitals stable. Oral intake: 2000cc; Urine output: 1700cc
 Lungs: clear, occlusion stable, dressings intact, surgical wounds closed primarily
 Diagnosis: Good post-op course, ready for discharge
 Plan: Discharge to home and return to OMFS clinic in 1 week for F/U

W. Guy, DDS

POST-OPERATIVE AND DISCHARGE ORDERS

ORAL AND MAXILLOFACIAL SURGERY

POST-OPERATIVE ORDERS

Date: 2 December 2011
 Time: 11:00
 Operation: ORIF left mandibular ramus, and naso-ethmoidal and orbital fracture
 Condition: Stable. Vitals q 15 min until stable, then q 1 hr, then q 4 hrs
 Allergies: Penicillin
 Activity: Out of bed with assistance this PM
 Diet: Soft
 IV D5½ NS at 125 cc/hr
 Ancef® 500mg (cefuroxime 750mg) IV q 6h
 Morphine sulfate 2mg IV x4 max in PARR only
 Demerol® (pethidine) 50mg/Phenergan 25mg IM q 4h PRN moderate to severe pain
 Ibuprofen (Ibuprofen) 600mg PO q 6h PRN mild to moderate pain
 Compazine® 10mg (Stemetil 125mg) IM q 4h PRN nausea or vomiting
 Ephedrine nasal spray 2 squirts each nostril PRN congestion
 Humidified 40% oxygen via face mask

(Continued)

Table A19-2 (Continued)

Record intake and output
 Elevate HOB 30 degrees
 Light oral suction at bedside
 Coughing and deep breathing q 2 hrs while awake
 Please page (pager #) for any questions or if:

BP systolic >80 or <00 mmHg

BP diastolic >00 or <0 mmHg

Pulse >00 or <0

Temp >01.5°F (38.5°C)

Severe nausea or vomiting

No void by 8h post-op

W. Guy, DDS

ORAL AND MAXILLOFACIAL SURGERY

OPERATIVE ORDERS

Date: 2 December 2011

Time: 17:00

1. IV to TKO
2. Discontinue oxygen
3. Encourage PO intake and ambulation

W. Guy, DDS

ORAL AND MAXILLOFACIAL SURGERY

DISCHARGE ORDERS

Date: 2 December 2011

Time: 19:00

1. Discharge to home
2. Keflex® 500mg PO QID x7 days
3. Ibuprofen 600mg PO q 4–6 hrs PRN pain
4. Return to OMFS clinic 10 October 2003 at 0900

W. Guy, DDS

OPERATIVE REPORT

ORAL AND MAXILLOFACIAL SURGERY

OPERATIVE REPORT

Date: 2 December 2011

Time: 17:00

Name: Darryl Johnson

Unit Number: 07 3359 113

Hospital location:

Date of operation: 2 October 2003

Date: 2 October 2003

Surgeons: V H Kazanjian and W Guy

Preoperative diagnosis: Left mandibular ramus fracture and left naso-orbito-ethmoid fracture

Postoperative diagnosis: Same

Operation: ORIF left mandibular ramus fracture ORIF left naso-orbito-ethmoid fracture

Table A19-2 (Continued)

Anesthesia: General via nasal endotracheal tube

Specimens: None

Blood loss: 100 cc

Fluid replacement: 1500 cc

Indications and consent: This 27 yo male sustained facial injuries including a L mandibular ramus fracture, a naso-ethmoidal and orbital fractures, as well as contusions and lacerations. He has a malocclusion consisting of a right posterior open bite and left posterior occlusal prematurity. The patient also has pain over the left mandibular ramus and midface. He is unable to breathe nasally due to septal deviation. The nature of the injuries and prognosis with and without treatment have been explained to the patient. He has given his consent for necessary treatment.

Procedure: The patient was taken to OR #7 and placed on the operating table in a supine position. An IV was already in place in the right forearm. General anesthesia was induced and the patient was nasally intubated. The patient was then positioned, prepped and draped in the usual fashion. A moistened throat pack was placed in the oropharynx. Maxillomandibular fixation, using 25-gauge stainless steel wire, was applied to establish proper occlusion. A skin marker was used to draw a line between the inferior aspect of the left tragus and the antegonial notch. A curvilinear line was drawn just beneath the middle third of this line. 6 cc 0.5% lidocaine with 1:200 000 epinephrine was infiltrated subcutaneously in this region. A 15 blade was used to incise through skin and subcutaneous tissue. Bleeding along the skin edges was coagulated using electrocautery. Lack of paralysis was confirmed by the anesthesiologist. Dissection was carried down to the lateral aspect of the mandibular ramus in a layered fashion. A nerve stimulator was used to test each layer prior to incising. The buccal and marginal mandibular branches of the facial nerve were located and protected with retractors. The fracture was identified, reduced and rigidly fixed with a double-Y Wurzburg miniplate and six 2.0 mm diameter, 7 mm length screws. IMF was released and occlusion was verified. The wound was irrigated and muscle was closed with 3-0 chromic gut in an interrupted fashion. Subcutaneous interrupted 4-0 chromic gut sutures were then placed, followed by skin closure with continuous 5-0 nylon sutures. 6 cc 2% lidocaine with 1:100 000 [1:80 000] epinephrine was used to infiltrate submucosally over the nasal septum. The deviated nasal septum was then straightened with an Ashe forceps and scalpel handle. A further 6 cc 2% lidocaine with 1:100 000 [1:80 000] epinephrine was then infiltrated in the maxillary vestibule. An incision was made at the depth of the left maxillary vestibule with a 15 blade. A periosteal elevator was used to expose the left anterior maxillary wall and the fracture site. The fractured segment involving the anterior maxilla and nasal bone was reduced and stabilized using a 6 hole straight Luhr microplate with six 4 mm screws. The wound was irrigated with normal saline and closed using 3-0 chromic gut suture to reapproximate the zygomaticus levator muscles. The mucosa was closed with 4-0 chromic gut suture in running horizontal mattress fashion. Arch bars were removed and the oral cavity was irrigated and suctioned. The throat pack was removed and the oro- and nasopharynx were suctioned. The left facial wound was dressed with bacitracin and Telfa™. The nose was dressed externally with Steri-Strips™ (Nexcare, a division of 3-M, Saint Paul, MN) and an Aquaplast® splint. (Sammons Preston, a division of Patterson Medical, Bolingbrook, IL) The patient was allowed to wake and was extubated. He was then taken to the recovery room in stable condition.

W. Guy, DDS

DISCHARGE SUMMARY

ORAL AND MAXILLOFACIAL SURGERY

DISCHARGE SUMMARY

Date: 2 December 2011

Time: 19:00

Patient: Darryl Johnson

Date of admission: 2 December 2011

Date of discharge: 3 December 2011

(Continued)

Table A19-2 (Continued)

Physician: V H Kasanjian DDS MD

History of present illness: This 27 yo male came to hospital after allegedly being assaulted at a local night club. He sustained a left mandibular ramus and naso-ethmoidal and orbital fractures, and facial contusions and abrasions.

Past medical history: The patient is otherwise in good health. His previous history is significant for other traumatic wounds.

Physical exam: Well-developed, well-nourished 27 yo male in mild/moderate distress secondary to facial injury. The patient presented with cervical collar in place but C-spine injury was ruled out shortly after arrival. Significant L facial edema was present with tenderness to palpation over the L mandibular ramus. Contusions and abrasions were present over the R face. Multiple pre-existing edentulous areas were present and there was a R posterior open bite with occlusal prematurity of the L posterior teeth. There was tenderness to palpation over the nasal bridge and gross mobility of the nasal bones. The intranasal exam exhibited hemorrhage and septal deviation. Subconjunctival ecchymosis was present and mild anisocoria (apparently pre-existing) was present. There was a palpable step at the L infraorbital rim. The patient exhibited sensory deficit of the V2 and V3 distributions. All other findings were within normal limits with the exception of old traumatic scars on the abdomen and extremities. All laboratory data were within normal limits. Radiographic evaluation was consistent with the clinical diagnosis.

Hospital course: The patient was admitted through the ER, placed on IV antibiotics and scheduled for surgery. The patient was taken to the OR where ORIF of facial fractures was performed. The patient tolerated the procedure well, was extubated in the OR and taken to the recovery room in stable condition. The remainder of the patient's postoperative course was uneventful and he was deemed ready for discharge the following morning. Upon discharge the patient was consuming PO fluid and solids, ambulating and urinating without difficulty.

Discharge diagnosis: Facial fractures

Operations and procedures:

ORIF left mandibular ramus fracture

ORIF left naso-ethmoidal and orbital fractures

Disability: Patient will be able to return to normal activities over the next 2 weeks

Discharge medications:

Cefalexin 500mg PO QID x7 days

Ibuprofen 600mg q 6hrs PRN pain

Follow-up care: Return to OMFS clinic on 10 December at 11:40

W. Guy, DDS

Appendix 20 Operating Room

Table A20-1 Dress Code

The appearance and dress of operating room (theatre) staff must adhere to the principles of safety, infection control, and professional standards. Adherence to these standards will lessen the opportunity for workers to serve as potential sources of infection.

The human body is a major source of microbial contamination within the operating room (OR) environment. Because it is not possible to sterilize skin, hair, and mucous membranes, other measures must be taken to reduce this source of potential pathogens.

Scrubs and Gowns

All personnel entering restricted areas of the surgical suite should be dressed in operating room apparel. At no time should street clothes be worn within the restricted areas of the surgical suite.

Hair Covers

All head and facial hair, including sideburns and neckline, should be covered in semi-restricted and restricted areas of the surgical suite.

- The surgical scrub cap or surgical hood should be clean and free of lint. Nets are not acceptable.
- Surgical caps or hoods must be changed upon returning to the surgical suite.

Shoe Covers

All personnel entering the restricted areas of the surgical suite should wear shoe covers.

- Shoe covers are removed upon leaving restricted areas of the suite.
- Clean shoe covers are put on upon returning to the restricted area.

Personal Effects

- Nail polish should not be worn by OR personnel. Fingernails should be kept clean and short. Artificial nails should not be worn.
- Earrings, if worn at all, must be small and unobtrusive, and worn under a scrub hat.
- Chains and necklaces must be contained inside the scrub shirt. Rings, watches, and bracelets should be removed.

Table A20-2 Scrub Technique

Many hospitals have changed the time-honored hand and arm scrub method with a brush and soap to a brushless scrub with scrub solution alone. One method is as follows:

- Use a nail pick to clean under fingernails to remove dirt and debris. Turn water on and wet hands and arms.
- Hold an open palm under solution dispenser port then depress the foot pump, dispensing approximately a 2-cc portion of solution into palm.
- Begin by cupping palm with solution, then insert opposite hands' fingertips into solution. Then twist fingertips around for a few seconds. Repeat with other hand.
- Rub hands together, beginning with both hands, then moving up to forearm region, extending slightly past the elbows.
- **Scrub for 90 seconds.**
- Rinse thoroughly, then repeat steps 2 through 4, stopping before the elbow on the second application. Total scrub time is three minutes.

Appendix 21 Patient Transfer

Rationale

Sophisticated surgical and restorative procedures require good visualization and access, which depend on appropriate patient positioning and orientation of the light source. Wherever possible, patients should receive restorative dental treatment in a fully adjustable dental chair with articulating headrest, if only out of consideration for operator fatigue. Dentists working in the hospital environment must be comfortable in transferring a patient from wheelchair to dental chair, and vice versa, if the opportunity is not available to incorporate the patient's wheelchair into a custom-made dental unit.

Pretransfer Assessment

- Can the patient transfer independently, or with what level of assistance? (Ask patient; check nursing notes.) Stroke patients tend to overestimate their abilities. Always be prepared to assist them when getting up from the wheelchair or dental chair.
- If capability is uncertain, can the patient follow directions?
- If the patient has a stronger side, which is it? Always transfer patient to the stronger side!
- If the patient is sitting on a canvas sling, this is evidence that a mechanical/hydraulic lift (a 'Hoyer or C-lift') is necessary for transfer. Such a device can be obtained from the ward or the operating room (theatre) but should not be employed without instruction and supervision.
- After dental treatment, a patient with orthostatic hypotension might need to be raised from the prone position in increments and allowed to sit for a few minutes before transfer from the dental chair.

- Whenever possible, use the hospital staff to complete the transfer. They may be familiar with the patient and aware of the patient's transfer requirements.
- Ask the transport personnel how the patient was transferred to the wheelchair.
- Back injuries are a common hospital occupational injury. Do not attempt a transfer without proper training and assistance.

Minimize Physical Barriers

- Check the patient for IV lines, drains, and cannulas to make sure these are not removed during transfer. Wear gloves during transfer if there is a chance of contact with body fluids.
- Remove waist restraints, vest restraints, and leg or arm restraints (such items are only for patient safety or to minimize contractures, and should not be viewed as a sign of a combative or dangerous patient).
- Locate catheter hoses and collecting bags, IV poles, infusion pumps, oxygen lines, or other therapeutic attachments in such a way as to pose no impediment to an efficient transfer.
- Remove everything possible from the wheelchair on the side to which transfer will be affected: arm rest, brake arm, leg support, foot support.
- Raise, retract, or remove the patient's arm from the dental chair to allow unimpeded transfer.

Preparation for the Transfer

- For a slideboard assist: Position wheelchair parallel to the dental chair. The chair should be at the same height or 3 to 6 inches lower than the wheelchair.
- For a minimal assist transfer: Position wheelchair in the optimal position as described by the patient, but modified to allow the operator clear access to the patient in the event of unsteadiness.
- For a one-person transfer: Position the chair parallel to the dental chair, with the patient's stronger side adjacent to the dental chair. The chair should be 3 to 6 inches lower than the wheelchair.
- For a two-person transfer: Position the chair parallel to the dental chair and facing the same direction as the dental chair, with the dental chair 3 to 6 inches lower than the wheelchair.
- Set the brakes on the wheelchair.
- Explain clearly and slowly the procedure that will be followed in the transfer. Make sure the patient understands his or her role.

The Transfer

- Slideboard transfer: The patient will effect the transfer. When complete, release the brakes and move the chair.

- Minimal assist: Prior to patient transfer, place a hand on patient's belt or waistband, or beneath patient's arm, to steady patient if necessary. When complete, release the brakes and move the chair.
- One-person transfer: Ask hemiplegic patients to hold the dependent arm with the intact arm. For all one-person assists, have patients:
 - Bend forward at the waist until nearly doubled over
 - Place their weight on the good leg (the one nearer the dental chair)
 - Rise slowly into the operator's grasp, as the operator gently pulls forward and up
 - Allow the operator to swivel the patient 90°.
 - Allow the operator to ease the patient down into the dental chair.
- Two-person transfer:
 - Make sure the patient's arms are crossed
 - One operator stands, with knees slightly bent, behind the patient and grips the patient's elbows
 - The other operator stands, with knees slightly bent, at the patient's knees, and grasps the patient's legs behind the knees and the calves
 - The operator behind the patient counts "one-two-three"; on three, both operators straighten their knees and lift patient out of wheelchair and into dental chair.
- Transferring the patient back to the wheelchair: The return transfer is the reverse of the preceding procedure. Some particular reminders:
 - If the patient had a "strong side" the wheelchair will need to face the opposite direction that it did before. In addition, any removable portions of the wheelchair will need to be replaced and the hardware on the opposite side removed.
 - As before, position all catheter hoses and collecting bags, IV poles, infusion pumps, oxygen lines or other therapeutic attachments so that they will not interfere with the transfer.
 - When the wheelchair is positioned, lock the brakes.
 - Raise the dental chair so that it is 3 to 6 inches higher than the wheelchair.
 - When the transfer is complete, replace all restraints, hoses, lines, IV poles, etc.

Appendix 22 Primary Dentition: Chronology

	Deciduous teeth	Permanent teeth eruption				
	Eruption maxillary (month)	Eruption mandibular (month)	Shedding maxillary (year)	Shedding mandibular (year)	Maxillary (year)	Mandibular (year)
Central incisors	6 to 8	5 to 7	7 to 8	6 to 7	7 to 8	6 to 7
Lateral incisors	8 to 11	7 to 10	8 to 9	7 to 8	8 to 9	7 to 8
Canines	16 to 20	16 to 20	11 to 12	9 to 11	11 to 12	9 to 11
First premolars	–	–	–	–	10 to 11	10 to 12
Second premolars	–	–	–	–	10 to 12	11 to 13
First molars	10 to 16	10 to 16	10 to 11	10 to 12	6 to 7	6 to 7
Second molars	20 to 30	20 to 30	11 to 13	12 to 13	12 to 13	12 to 13
Third molars	–	–	–	–	17 to 22	17 to 22

Appendix 23 Prophylaxis

Risk Assessment for Bacteremia and the Need for Prophylactic Antibiotics

Many of the dental management issues with medically complex patients revolve around the use of antibiotics, either as prophylaxis or treatment. The evidence base for the use of prophylactic antibiotics prior to invasive dental procedures for prevention of infective endocarditis, prosthetic joint infections, other distant site infections, or bacteremia/sepsis (in profoundly neutropenic patients) is weak at best, and guidelines are often inconsistent between various professional groups.

As a general guide, all patients must be considered individually and their host resistance factors assessed (e.g., immunity, drugs, disease, debilitation). If a patient is at risk, determine which antibiotic to use and the dose, route, and duration based on the oral organisms most likely to cause infection. Antibiotic prophylaxis is indicated for some cardiac conditions (e.g., prosthetic cardiac valves) but data are not sufficient to recommend routine prophylaxis for any of the many other conditions that are reported to put patients at risk from an invasive dental procedure.

Table A23-1 American Heart Association

Prevention of Bacterial Endocarditis

The American Heart Association (AHA) first developed guidelines for antibiotic prophylaxis for specific cardiac conditions in 1955. Like the versions that they supersede, the most recent 2007 AHA guidelines suggest that there is still some uncertainty as to which dental procedures and which patients to cover.* One of the major changes in the new guidelines is the dictation that antibiotic prophylaxis with dental procedures is now recommended only for patients with cardiac conditions associated with the *highest risk of adverse outcomes from endocarditis*. As the title of the publication suggests, the guidelines are specifically aimed at the prevention of infective endocarditis. These guidelines are not intended to be used for other medical conditions, such as prosthetic joints. The reader is encouraged to read the sections in the original publication in *Circulation* or *Journal of the American Dental Association*.

Cardiac Conditions Associated with the Highest Risk of Adverse Outcome from Endocarditis for Which Prophylaxis with Dental Procedures Is Reasonable

1. Prosthetic cardiac valve or prosthetic material used for cardiac valve repair
2. Previous infective endocarditis (IE)
3. Congenital heart disease (CHD)*
Unrepaired cyanotic CHD, including palliative shunts and conduits
Completely repaired congenital heart defect with prosthetic material or device, whether placed by surgery or by catheter intervention, during the first six months after the procedure†
Repaired CHD with residual defects at the site or adjacent to the site of a prosthetic patch or prosthetic device (which inhibit endothelialization)
4. Cardiac transplantation recipients who develop cardiac valvulopathy

*Except for the conditions listed above, antibiotic prophylaxis is no longer recommended for any other form of CHD.

†Prophylaxis is reasonable because endothelialization of prosthetic material occurs within six months after the procedure.

Dental Procedures for Which Endocarditis Prophylaxis Is Reasonable for Patients

All dental procedures that involve manipulation of gingival tissue or the periapical region of teeth or perforation of the oral mucosa*

*The following procedures and events do not need prophylaxis: Routine anesthetic injections through noninfected tissue, taking dental radiographs, placement of removable prosthodontic or orthodontic appliances, adjustment of orthodontic appliances, placement of orthodontic brackets, shedding of deciduous teeth, and bleeding from trauma to the lips or oral mucosa.

Regimens for a Dental Procedure

		Regimen: Single dose 30 to 60 minutes before procedure	
Situation	Agent	Adults	Children
Oral Unable to take oral medication	Amoxicillin	2 g	50mg/kg
	Ampicillin	2 g IM or IV	50mg/kg IM or IV
	OR		
	Cefazolin or ceftriaxone	1 g IM or IV	50mg/kg IM or IV

Table A23-1 (Continued)

Situation	Agent	Regimen: Single dose 30 to 60 minutes before procedure	
		Adults	Children
Allergic to penicillins or ampicillin—oral	Cephalexin*†	2 g	50 mg/kg
	OR		
	Clindamycin	600 mg	20 mg/kg
Allergic to penicillins or ampicillin and unable to take oral medication	OR		
	Azithromycin or clarithromycin	500 mg	15 mg/kg
	Cefazolin or ceftriaxone†	1 g IM or IV	50 mg/kg IM or IV
	OR		
	Clindamycin	600 mg IM or IV	20 mg/kg IM or IV

IM = intramuscular; IV = intravenous
 *Or other first- or second-generation oral cephalosporin in equivalent adult or pediatric dosage.
 †Cephalosporins should not be used in an individual with a history of anaphylaxis, angioedema, or urticaria with penicillins or ampicillin.

Wilson W, Taubert KA, Gewitz M, Lockhart PB, Baddour LM, Levison M, Bolger A, Cabell CH, Takahashi M, Baltimore RS, Newburger JW, Strom BL, Tani LY, Gerber M, Bonow RO, Pallasch T, Shulman ST, Rowley AH, Burns JC, Ferrieri P, Gardner T, Goff D, Durack DT. Prevention of Infective Endocarditis. Guidelines from the American Heart Association. A Guideline from the American Heart Association Rheumatic Fever, Endocarditis, and Kawasaki Disease Committee, Council on Cardiovascular Disease in the Young, and the Council on Clinical Cardiology, Council on Cardiovascular Surgery and Anesthesia, and the Quality of Care and Outcomes Research Interdisciplinary Working Group. *Circulation* 116(15):1736–1754. 2007.

Table A23-2 American Dental Association and American Academy of Orthopedic Surgeons

In 1997 and 2003, the American Dental Association (ADA) and American Academy of Orthopedic Surgeons (AAOS) published an advisory statement on the dental management of patients with prosthetic joints (see Chapter 2). In February 2009, the AAOS published an “Information Statement” entitled “Antibiotic Prophylaxis for Bacteremia in Patients with Joint Replacements.” This AAOS Information Statement suggests that: “Given the potential adverse outcomes and cost of treating an infected joint replacement, the AAOS recommends that clinicians consider antibiotic prophylaxis for all total joint replacement patients prior to any invasive procedure that may cause bacteremia.” New guidelines from the ADA and AAOS were pending at the time this book went to press.

American Academy of Orthopedic Surgeons. Information Statement. Antibiotic Prophylaxis for Bacteremia in Patients with Joint Replacements. © February 2009 American Academy of Orthopaedic Surgeons®. Revised June 2010 (www.aaos.com).

Table A23-3 Steroid Prophylaxis for Adrenal Insufficiency

- The major consideration for patients taking steroids is suppression of adrenal capacity to respond to stressful situations.
- Increasing the steroid dose for surgical procedures is rarely necessary but the risk from increasing the steroid dose is minimal to nonexistent. It is difficult to predict who might have an adrenal crisis under stress. The risk of this occurring during dental treatment is likely overstated and supplemental steroids are rarely indicated.
- Patients who have had prolonged or significant dental infection will benefit most from supplemental corticosteroids, particularly if surgical extractions are anticipated or general anesthesia is planned.
- Patients on very low doses (e.g., 5 mg prednisolone/day) or for short time periods (e.g., less than 10 days), or high doses (e.g., more than 40 mg prednisolone), or those undergoing short and nonstressful dental procedures likely do not benefit from supplementation. Patients on high doses (more than 40 mg/day) of prednisone would not normally require a supplemental dose, except perhaps for major surgery and/or general anesthesia.
- For patients on larger doses and/or for longer periods, consider either doubling the patient's daily dose the morning of the procedure up to the physiologic output of adrenal glands (i.e., 20 to 30 micrograms/deciliter/day), or give 100 to 200 mg of intramuscular or intravenous hydrocortisone 30 minutes prior to the planned procedure. Consider supplementation 12 hours after the procedure as well.
- Some clinicians begin steroid supplementation the day before the procedure and continue it through the day following the procedure.
- Patients off long-term, high-dose steroids for over six months can have the drug instituted the day prior to treatment, at the discretion of the physician.
- Consult with the patient's physician to determine current adrenal status, the reason for and duration of steroid therapy, and regarding adjustment of steroid dose prior to stressful dental treatment if the patient's adrenal glands function poorly or not at all.
- The normal daily physiologic output of cortisol is 24 to 30 mg (equivalent to 5 to 7.5 mg prednisolone).
- The general goal for supplementation is to have 50 to 75 mg hydrocortisone available systemically for moderately stressful (surgical or psychological) procedures and 100 to 150 mg hydrocortisone/day for day of surgery and two to three days postoperatively for highly stressful procedures.
- Keep in mind that a major precipitating factor in an adrenal crisis is hypovolemia. Therefore, ensure that the patient is well hydrated prior to the procedure.

Suggested Reading

Baid SK, Nieman LK. Therapeutic Doses of Glucocorticoids: Implications for Oral Medicine. *Oral Diseases* 12, 436–442. 2006.

Appendix 24 Splint and Tray Construction

Table A24-1 Anesthesia Splint

Definition

A carefully molded splint from a vacuum former is used to stabilize periodontally or prosthetically (e.g., crowns, bridges) involved teeth by distributing any forces delivered during intubation or from an endotracheal tube over as many additional teeth as possible. Used primarily for maxillary anterior teeth during intubation, it might also be desirable for electroconvulsive therapy.

Method

- Obtain an alginate impression of the maxillary teeth and pour a stone or plaster model.
- Place a sheet of mouth guard soft plastic and 0.020 thickness hard plastic on the vacuum former, with the 0.020 on top (closest to the heat).
- Heat the sheets until they sag below the vacuum former frame.
- Turn on the vacuum and lower the softened sheets onto the model.
- When cool, remove the model and trim the plastic material to the gingival area.
- Lightly smooth all margins with an acrylic bur and a heated Hanau torch flame.
- Disinfect or sterilize as needed.
- Attach to the patient's chart or give to the anesthesiologist.

Table A24-2 Medication Tray Construction

Definition

Trays are used for delivering fluoride gel to dentate patients with xerostomia (e.g., patients following head and neck radiotherapy, or with Sjögren's syndrome), and occasionally to deliver medications to the gingiva (e.g., topical steroids).

Method

- Obtain full arch alginate impressions of both upper and lower teeth and pour a stone or plaster model.
- Trim the model and create a hole through the midpalate and/or midfloor of the mouth space.
- Mark the periphery of the tray, on the gingiva of the model, 1 to 2 mm beyond the gingival margin.
- Heat a sheet of mouth guard plastic on the vacuum former.
- Heat the plastic until it sags at least one inch. Turn the vacuum on and lower the plastic onto the model; allow it to cool.
- Transcribe a line on the plastic with an ink pen over the existing line on the model while it is still on the plaster model. The tray is then removed and trimmed to the marked line.
- Replace the tray on the model and sear all margins carefully until smooth using a Hanau torch with an air stream.
- Allow the tray to cool.
- Deliver the tray to the patient with a prescription for neutral sodium or stannous fluoride, 10 to 15 drops/tray, to be used every night for five minutes after brushing and flossing. Neutral sodium fluoride may be necessary for patients with mucositis.

Appendix 25 Staging

Table A25-1 Staging and Management of BRONJ

Stage (AAOMS)	Clinical presentation	Management
At risk category	No apparent necrotic bone in patients who have been treated with either oral or IV bisphosphonates	Patient education, no treatment indicated
0	No clinical evidence of necrotic bone, but nonspecific clinical findings and symptoms	Systemic management, including the use of pain medication and antibiotics
1	Asymptomatic exposed bone and no evidence of infection	Patient education, antibacterial rinses, careful follow-up
2	Exposed bone with pain and with clinical evidence of infection	Patient education, antibacterial rinses, antibiotics, superficial debridement of bone to dislodge loose fragments and smooth rough contours, careful follow-up
3	Exposed bone with pain, infection, and one or more of the following: pathologic fracture, extra-oral fistula, or osteolysis extending to the inferior border	Patient education, antibacterial rinses, antibiotics, palliative debridement/resection surgery

Adapted from: Ruggiero SL, Dodson TB, Assael LA, Landesberg R, Marx RE, Mehrotra B, American Association of Oral and Maxillofacial Surgeons. American Association of Oral and Maxillofacial Surgeons Position Paper on Bisphosphonate-Related Osteonecrosis of the Jaws—2009 Update. *J Oral Maxillofac Surg* 67(5 Suppl):2–12. May 2009.

Table A25-2 TNM Staging for Tumors of the Lip and Oral Cavity

Primary tumor (T)	
TX	Primary tumor cannot be assessed
T0	No evidence of primary tumor
Tis	Carcinoma <i>in situ</i>
T1	Tumor less than or equal to 2 cm in greatest dimension
T2	Tumor greater than 2 cm but less than or equal to 4 cm in greatest dimension
T3	Tumor greater than 4 cm in greatest dimension
T4a	Moderately advanced local disease. [†] Lip: Tumor invades through cortical bone, inferior alveolar nerve, floor of mouth, or skin of face, that is, chin or nose Oral cavity: Tumor invades adjacent structures only (e.g., through cortical bone [mandible or maxilla] into deep [extrinsic] muscle of tongue [genioglossus, hyoglossus, palatoglossus, and styloglossus], maxillary sinus, or skin of face)
T4b	Very advanced local disease Tumor involves masticator space, pterygoid plates, or skull base and/or encases internal carotid artery
Regional lymph nodes (N)	
NX	Regional lymph nodes cannot be assessed
N0	No regional lymph node metastasis
N1	Metastasis in a single ipsilateral lymph node, less than or equal to 3 cm in greatest dimension
N2	Metastasis in a single ipsilateral lymph node, greater than 3 cm but less than or equal to 6 cm in greatest dimension Metastases in multiple ipsilateral lymph nodes, none greater than 6 cm in greatest dimension Metastases in bilateral or contralateral lymph nodes, none greater than 6 cm in greatest dimension
N2a	Metastasis in single ipsilateral lymph node, greater than 3 cm but less than or equal to 6 cm in greatest dimension
N2b	Metastases in multiple ipsilateral lymph nodes, none greater than 6 cm in greatest dimension
N2c	Metastases in bilateral or contralateral lymph nodes, none greater than 6 cm in greatest dimension
N3	Metastasis in a lymph node greater than 6 cm in greatest dimension
Distant metastasis (M)	
M0	No distant metastasis
M1	Distant metastasis

[†]Superficial erosion alone of bone/tooth socket by gingival primary is not sufficient to classify a tumor as T4.

Stage grouping

Stage 0	Tis	N0	M0
Stage I	T1	N0	M0
Stage II	T2	N0	M0
Stage III	T3	N0	M0
	T1	N1	M0
	T2	N1	M0
	T3	N1	M0
Stage IVA	T4a	N0	M0
	T4a	N1	M0
	T1	N2	M0
	T2	N2	M0
	T3	N2	M0
	T4a	N2	M0
Stage IVB	Any T	N3	M0
	T4b	Any N	M0
Stage IVC	Any T	Any N	M1

Histologic grade (G)

GX	Grade cannot be assessed
G1	Well differentiated
G2	Moderately differentiated
G3	Poorly differentiated
G4	Undifferentiated

Additional descriptors

Lymphatic vessel invasion (L) and venous invasion (V) have been combined into lymph-vascular invasion (LVI) for collection by cancer registrars

Lymph-vascular invasion not present (absent)/not identified
Lymph-vascular invasion present/identified
Not applicable
Unknown/indeterminate

Residual tumor (R)

RX	Presence of residual tumor cannot be assessed
R0	No residual tumor
R1	Microscopic residual tumor
R2	Macroscopic residual tumor

General notes:

For identification of special cases of TNM or pTNM classifications, the “m” suffix and “y,” “r,” and “a” prefixes are used. Although they do not affect the stage grouping, they indicate cases needing separate analysis.

m suffix indicates the presence of multiple primary tumors in a single site and is recorded in parentheses: pT(m)NM.

y prefix indicates cases in which classification is performed during or following initial multimodality therapy. The cTNM or pTNM category is identified by a “y” prefix. The ycTNM or ypTNM categorizes the extent of tumor actually present at the time of the examination. The “y” categorization is not an estimate of tumor prior to multimodality therapy.

r prefix indicates a recurrent tumor when staged after a disease-free interval, and is identified by the “r” prefix: rTNM.

a prefix designates the stage determined at autopsy: a TNM.

Appendix 26 Trauma: Head Injury Sheet

Example of an instruction sheet for patients with head injuries.

Instruction sheet for patients with head injuries

_____ (Hospital) _____ (Doctor's Name)

_____ (Address) _____ (Phone)

HEAD INJURY SHEET

Dr. _____ has examined you for evidence of brain injury. Signs of trouble could develop later at home, and we ask you to be on the lookout for them.

SIGNS OF TROUBLE

1. Increasing drowsiness, hard to arouse (If the patient is alert and easily awakened, (s)he is probably safe).
2. Other signs:

Unequal pupil size	Problems with vision or "seeing double"
Vomiting	Headache
"Convulsions" (fits)	Bleeding or clear fluid from the ears or nose
Numbness	Stumbling or other problems with arms or legs
Confusion	

INSTRUCTIONS

Return to this clinic/emergency department if you are concerned or if you experience any of the signs of trouble listed above.

1. Patient should rest at home for the next 24 hours with someone who can check on them at least every four hours.
2. During this period, no alcoholic beverages should be taken.
3. Arousal periodically for children if sleeping.
4. Follow-up appointment, if needed. Specify where and when.

Appendix 27 Venipuncture

Definition

Venipuncture is used to insert a needle for administration of fluids, electrolytes, anesthetics, sedation agents, and medications, as well as for drawing blood.

Method

- The arm is positioned on the table, bed, or arm of chair, and stabilized with other free hand.
- The equipment is organized. The hands are washed thoroughly and dried.
- The needle is screwed into the blood collection device and a towel is placed under the extremity.
- Vein selection is based on which vein is the largest, most easily observable, and palpable. This is usually the median cubital vein or cephalic vein in the antecubital fossa, or the metacarpal veins in the dorsum of the hand, the cephalic or basilic veins.
- Tourniquet (either a rubber tubing held with a slip knot or a blood pressure cuff pumped just below diastolic pressure) is applied to upper arm, if selected vein is in antecubital fossa, or forearm if a vein on dorsum of hand is used.
- Gloves are put on.
- Skin site is prepared by rubbing with gauze sponges soaked in 70% alcohol or comparable disinfectant, starting at the vein and circling outward to a two-inch diameter.
- The cap is removed from the needle. With thumb of same hand, the skin is pulled taut just distal to the planned venipuncture site to prevent the vein from rolling away from the needle tip.
- Cannula needle is placed in line with the vein with bevel up. Needle is inserted through skin at 15° to 30° angle.

- When lumen of vein is located, a decrease in resistance to penetration is felt and there is usually a back-flow of blood into the adapter of the infusion tube.
- The angle of the needle is decreased until it is flush with the skin and the plastic catheter moved cautiously up the vessel lumen. The cannula needle is removed and discarded in the sharps container.
- The tourniquet is relaxed.
- The IV tubing (line) is connected to the catheter hub and adequate fluid flow is assured.

Note: If the site is also to be used for blood drawing, a plastic syringe should be connected to the catheter hub and blood withdrawn from the vein prior to connection of the IV line. A needle is then placed on the plastic syringe and the blood is injected into the specific blood drawing tube for the desired lab test.

- Anchoring the catheter and securing the arm board:
 - The catheter is taped flush with the skin
 - A five-inch strip of tape is placed under the hub of the needle and each end is wrapped tightly and diagonally, criss-crossing over the junction of the catheter and the hub. Additional tape can be used to secure the IV tubing against the arm
- Method of blood drawing with Vacutainer® system:
 - The glass collection tube can be connected to the system and allowed to fill two-thirds to three-fourths with blood while the system is held in place. When stabilizing the system, the first glass collection tube can be removed and replaced by additional tubes as needed.
 - When enough blood has been collected, the tourniquet is relaxed and the needle (with system and last collection tube in place) is withdrawn while applying pressure at the site with a gauze sponge. Pressure is held for two to three minutes, longer if the patient is on anticoagulant therapy.
 - Proper labels are attached to each tube of blood and appropriate forms filled out.
 - Equipment is disposed of properly.
 - Gloves are removed and hands are washed.

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